

State of Hawaii  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
Division of Aquatic Resources  
Honolulu, Hawaii 96813

June 9, 2006

Board of Land and  
Natural Resources  
Honolulu, Hawaii

REQUEST FOR AUTHORIZATION/APPROVAL TO ISSUE ONE (1) NORTHWESTERN  
HAWAIIAN ISLANDS (NWHI) RESEARCH, MONITORING AND EDUCATION PERMIT  
TO CHRISTINA CLAIRE JOHNSON OF THE NATIONAL OCEANIC AND  
ATMOSPHERIC ADMINISTRATION (NOAA), NATIONAL MARINE SANCTUARY  
PROGRAM (NMSP), FOR EDUCATION AND OUTREACH ACTIVITIES  
AT KURE ATOLL AND PEARL AND HERMES ATOLL,  
VALID FROM JUNE 29, 2006 TO JULY 14, 2006

Submitted herewith for your authorization and approval is a request for issuance of a NWHI Access Permit to Christina Claire Johnson of NOAA, NMSP. The Research, Monitoring and Education Permit, described below, will allow activity to occur in the NWHI State marine Refuge (0-3 miles) waters surrounding Pearl and Hermes Atoll and Kure Atoll. The activities covered under this permit will occur from June 29, 2006 to July 14, 2006, from the support vessel Hi'ialakai.

Experiential education is the cornerstone for change, and exposure of a select group of educators to the unique environments of the NWHI will have a ripple effect through the broader Hawai'i education community, and inspire other teachers to learn about the NWHI and teach about them in their classrooms. Since it would be too great an impact to bring a large number of educators to the NWHI for a first hand experience, NOAA and its State education partners have pursued the strategy of bringing select teachers on education and research expeditions so that they can bring back their experience and share it with others.

The proposed activities (below) are consistent with and support the purposes of the Refuge, primarily to educate the public and raise awareness about resources within the State marine Refuge.

Educators will provide an experiential educational experience in the NWHI State Marine Refuge to a select group of educators so that they can "bring the place to the people" of the main Hawaiian Islands. Furthermore, they will conduct snorkeling and SCUBA diving operations in order to interpret the mapping and maritime heritage research for a broad audience, conduct REEF fish surveys, and record underwater sounds for the Sanctuary Sounds project. They will enhance the general understanding of NWHI ecosystems and resources through numerous and diverse education and outreach activities.

REVIEW PROCESS:

The permit was received by the Division of Aquatic Resources on April 19, 2006. It was sent out for review and comment to the following scientific entities: Division of Aquatic Resources staff (5), Division of Forestry and Wildlife, Northwest Hawaiian Islands Coral Reef Ecosystem Reserve, United States Fish and Wildlife Service. Native Hawaiians from the Office of Hawaiian Affairs, and Kaho'olawe Island Reserve Commission were also consulted.

As of May 30, 2006, two review comments have been received. The staff of the Division of Aquatic Resources has requested justifications for the educational team to go for scuba diving activities in the area. See the Response section below for the Applicant's explanation on this issue.

In addition, the Division of Aquatic Resources received comments from the Northwest Hawaiian Islands Coral Reef Ecosystem Reserve, which supports the application and the issuance of permit with the condition that mode of attachment of the AULS must not pose an entanglement hazard to marine life. The Reserve also recommends that applicants should be provided with a briefing on the Native Hawaiian cultural significance of the area, and that discharge must be regulated in accordance with Reserve prohibitions when transiting Reserve waters. See Attachment 1 for detail of the Reserve's comments.

No other comments were received from the Scientific Community or from a Native Hawaiians.

RESPONSE:

In response to the inquiry for justifications for scuba diving, the Applicant has furnished the following response:

*As requested, here are the justifications for diving for Claire on the education permit:*

- *Deploy and recover the AULS (Listening Station)*
- *Photograph teachers from underwater while conducting REEF fish census data collection on snorkel*
- *Conduct REEF fish census data collection on SCUBA*
- *Collect public domain underwater imagery (will be available on the public-accessible Media Library for download by any one) for expedition web site, lesson plans and other education and outreach resources*
- *Assist in Maritime Heritage archaeological research*
- *Photograph Maritime Heritage archaeology research to collect public domain imagery*
- *Gain first-hand experience with the Maritime Heritage archaeological research in the field*
- *Maintain NOAA Science Diver proficiency*

FINAL STAFF RECOMMENDATIONS:

- 1) Allow the proposed education activities to enable educators to enhance the general understanding of NWHI ecosystems and resources through diverse education and outreach activities

RECOMMENDATION:

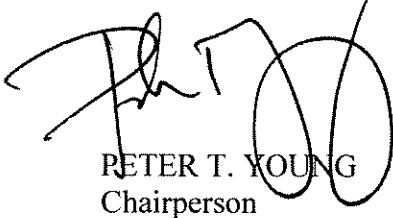
“That the Board authorize and approve, with stated conditions, a Research, Monitoring and Education Permit to Christina Claire Johnson of the National Oceanic and Atmospheric Administration, for activities and access within the State waters of the NWHI.”

Respectfully submitted,



DAN POLHEMUS  
Administrator

APPROVED FOR SUBMITTAL



PETER T. YOUNG  
Chairperson

**Northwestern Hawaiian Islands Coral Reef Ecosystem Reserve**  
**NOAA/NOS/NMSP**  
Comments on State of Hawaii NWHI Marine Refuge Permits

PERMIT SUMMARY

**Title:** Bringing the Place to the People: Expanding Understanding and Awareness of the Northwestern Hawaiian Islands

**Project Leader:** Claire Johnson

**Location:** Kure Atoll and Pearl and Hermes Atoll

**Description:** Snorkeling and limited SCUBA for observation and photo-documentation of the maritime archaeology research.

BACKGROUND

The National Marine Sanctuaries Act mandates that NOAA's National Marine Sanctuary Program enhance public awareness, understanding, and appreciation of the marine environment. Education helps to forward the mission of increasing the knowledge of and appreciation for the special ocean region of the NWHI.

MANAGEMENT RELEVANCE TO THE RESERVE

As stated above, enhancing public awareness, understanding, and appreciation of the marine environment is a mandate for the National Marine Sanctuaries Program and a priority for the Reserve.

POTENTIAL IMPACTS

The 5-member education team will be snorkeling at potentially sensitive sites where maritime archaeology research will be taking place. As such the team should receive a briefing by both the Maritime Heritage Principal Investigator and a state representative on the appropriate protocols and guidelines to follow when snorkeling in the area.

RESERVE RECOMMENDATION

The Reserve supports the education mission and activities outlined in the permit application and recommends conditionally issuing the permit as requested (see conditions below).

**Need further clarification on:** No further clarification needed.

**Specific Recommendations:**

- Applicants should be provided with a briefing on the Native Hawaiian cultural significance of the area.
- Discharge must be regulated in accordance with Reserve prohibitions when transiting Reserve waters.

**Conditions:**

1. Mode of attachment of the AULS must not pose an entanglement hazard to marine life.

<p><input type="radio"/> Approve</p> <p><input checked="" type="radio"/> Approve with conditions</p> <p><input type="radio"/> Disapprove</p>
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**Reserve staff Reviewers:**

- ☒ Malia Chow, Ph.D.
- ☒ Randy Kosaki, Ph.D.
- ☒ Moani Pai
- ☒ Kekuewa Kikilo
- ☒ Hoku Johnson

Manager's concurrence with staff recommendation



Aulani Wilhelm, Acting Reserve Manager

## APPENDIX 1

**State of Hawai'i  
DLNR  
Northwestern Hawaiian Islands State Marine  
Refuge  
Permit Application Form**

**For Office Use Only**

Permit No:

Expiration date:

Date Appl. Received:

Appl. Fee received:

NWHI Permit Review Committee date:

Board Hearing date:

Post to web date:

**Type of Permit**

- ☒ I am applying for a **Research, Monitoring & Education** permit. (Complete and mail Application)
- ☒ This application is for a NEW project in the State Marine Refuge.
- ☐ This application is for an ANNUAL RENEWAL of a previously permitted project in the State Marine Refuge.
- ☐ I am applying for a permit for a **Native Hawaiian** permit. (Complete and mail Application)
- ☐ This application is for a NEW project in the State Marine Refuge.
- ☐ This application is for an ANNUAL RENEWAL of a previously permitted project in the State Marine Refuge.
- ☐ I am applying for a **Special Activity** permit. (Complete and mail Application)
- ☐ This application is for a NEW project in the State Marine Refuge.
- ☐ This application is for an ANNUAL RENEWAL of a previously permitted project in the State Marine Refuge.

Briefly describe **Special permit** activity:

When will the NWHI activity take place?

- ☒
- Summer**
- (May-July of
- 2006
- (year)

Note: Permit request must be received before February 1st

Specific dates of expedition \_\_\_\_\_

- ☐
- Fall**
- (August-November) of \_\_\_\_\_ (year)

Note: Permit request must be received before May 1<sup>st</sup>

Specific dates of expedition \_\_\_\_\_

- ☐
- Other**

**NOTE: INCOMPLETE APPLICATIONS WILL NOT BE ACCEPTED****Please Send Permit Applications to:**

NWHI State Marine Refuge Permit Coordinator  
State of Hawai'i  
Department of Land and Natural Resources  
Division of Aquatic Resources  
1151 Punchbowl Street, Room 330  
Honolulu, Hawai'i 96813

## Section B: Project Information

### 8. (a) Project Location

☒ NWHI State Marine Refuge (0-3 miles) waters surrounding:

- ☐ Nihoa Island
- ☐ Necker Island (Mokumanamana)
- ☐ French Frigate Shoals
- ☐ Laysan
- ☐ Maro
- ☐ Gardner Pinnacles
- ☐ Lisianski Island, Neva Shoal
- ☒ Pearl and Hermes Atoll
- ☒ Kure Atoll, State Wildlife Refuge
- ☐ Other NWHI location

Describe project location (include names, GPS coordinates, habitats, depths and attach maps, etc. as appropriate).

Education snorkels are anticipated to take place at Pearl and Hermes Atoll and Kure Atoll, State Wildlife Refuge. The education team is conferring with the NWHICRER and State of Hawai'i research coordinators to determine appropriate snorkeling sites that will have minimal impact on the habitat and resources, as well as not influence any current monitoring efforts in the NWHI. Below is a listing of specific, pre-determined sites, while other snorkeling sites will be determined in the next month in consultation with the reserve and State research coordinators.

Specific snorkel locations for Pearl and Hermes Atoll include:

- SW forereef near Pearl and Hermes wrecks – lat/long not disclosed
- Sheltered patch reef inside lagoon, SE side (27.8268 – 175.7920)
- Forereef in the vicinity of the Casitas site (27.962 – 175.771)

Specific snorkel location for Kure Atoll, State Wildlife Refuge include:

- CREWS buoy, center of lagoon (28.4180 – 178.3444)
- Sheltered backreef, North side of atoll (28.4522 – 178.3751)

Snorkeling for observation and photo-documentation of the maritime archaeology research will take place in conjunction with Hans Van Tilburg and the maritime heritage archaeology team. Note that at this time, specific locations (latitude/longitude) for historically significant heritage resources is considered sensitive data – not to be distributed publicly. Scuba diving will be limited since only one person from the education team will be qualified to scuba dive in support of the maritime heritage archaeology research.

### (b) check all actions to be authorized:

- ☒ Enter the NWHI Marine Refuge waters
- ☐ Take (harvest)      ☐ Possess      ☐ Transport (☐ Inter-island    ☐ Out-of-state)
- ☐ Catch      ☐ Kill      ☐ Disturb    ☒ Observe
- ☐ Anchor      ☒ Land (go ashore)      ☐ Archaeological research
- ☐ Interactions with Sea Turtles or Monk Seals    ☐ Interactions with Seabirds
- ☐ Interactions with Live Coral, Ark Shells or Pearl Oysters

greater ocean awareness and environmental literacy of the general public as an important goal of resource management agencies. The proposed education and outreach activities will continue to build off the successful efforts of previous NWHI research cruises with an education emphasis, as well as the dedicated education cruise to the NWHI in August of 2005 (USFWS permit).

Education and outreach activities will be conducted by five members of the education team aboard the NOAA ship *Hi'ialakai*: one non-formal educator acting as principle investigator for the education team; one State of Hawai'i educator selected by the NWHICRER and State partners; one State of Hawai'i media and outreach coordinator; one nationally selected NOAA Teacher-at-Sea; and one media person with regional and national media outlets. This education team will help forward the mission of increasing knowledge of, and appreciation for the special ocean region of the NWHI. Giving educators the opportunity to visit this special place, and to conduct ecosystem monitoring with similar protocols to those used by the NWHI researchers, will help to increase understanding of marine science, Native Hawaiian culture, conservation management, and ecosystems of the Hawaiian archipelago. As part of the expedition requirements, participating educators will develop lesson plans, activities and educational interactive maps that will not only be used in their classrooms but available to other educators. These newly developed educational resources will compliment the existing Navigating Change curriculum developed by NWHICRER and State educational partners to motivate people to change their attitudes and behaviors to better care for the NWHI and main Hawaiian Islands and our ocean resources.

The objectives of the education and outreach team are to:

- 1) provide an experiential educational experience in the NWHI State Marine Refuge, NWHICRER and the Hawaiian Islands National Wildlife Refuge to a select group of educators so that they may use this experience to "bring the place to the people" of the main Hawaiian Islands and increase knowledge of and support for conservation;
- 2) interpret the mapping and maritime heritage research for a broad audience;
- 3) conduct REEF fish surveys, general observation data collection and photography while snorkeling and scuba diving at Pearl and Hermes Atoll, and Kure Atoll, State Wildlife Refuge;
- 4) gain first-hand familiarity snorkeling and scuba diving in the ecologically diverse coral reef ecosystem of the NW Hawaiian Islands to interpret these experiences to reach broader audiences through established education and outreach methods;
- 5) provide a venue and mechanisms for participating teachers to share and distribute the materials they develop and their experience to other educators, schoolchildren and the general public;
- 6) deploy and recover the AULS in support of the Sanctuary Sounds project;
- 7) enhance the general understanding of the NWHI ecosystems and resources through education and outreach in collaboration with NWHICRER and State of Hawai'i education partners.

Describe how your proposed activities will help provide information or resources to fulfill the State Marine Refuge purpose and to reach the Refuge goals and objectives.

- Give reasons why this activity must take place in the NWHI and cannot take place in the Main Hawaiian Islands, or elsewhere.

Experiential education is the cornerstone for change, and exposure of a select group of educators to the unique environments of the NWHI will have a ripple effect through the broader Hawai'i education community, and inspire other teachers to learn about the NWHI and teach about them in their classrooms. Since it would be too great an impact to bring a large number of educators to the NWHI for a first hand experience, NOAA and its State education partners have pursued the strategy of bringing select teachers on education and research expeditions so that they can bring back their experience and share it with others. A few examples of this ripple effect from the August 2005 education cruise to the NWHI includes: State of Hawai'i standards-based lesson plans that compliment the Navigating Change curriculum are available for download on <http://hawaiianatolls.org>; a school play titled "Heart of Honu" focused on conservation in the NWHI coral reef ecosystem; newspaper articles with stunning imagery targeted at the public-at-large (i.e. Honolulu Advertiser); Hawaiian music and chants focused on the NWHI; and regionally and nationally significant conference presentations with personal accounts from educators that touch



first-hand experiences gained in observing the coral reef ecosystem and collecting non-obtrusive fish survey data at the NWHI will give the educators the opportunity to conduct ecosystem-monitoring protocols similar to those used by NWHI researchers.

The education team would also like to observe research being conducted on-site by the maritime archaeology team at Pearl and Hermes Atoll, and Kure Atoll, State Wildlife Refuge through passive observations and non-obtrusive photography while snorkeling and scuba diving. Allowing educators an opportunity to observe research activities in the field in a remote location like the NWHI will help them understand the challenges involved in studying such a vast and wild ecosystem.

The education team will then take these first-hand observations and develop logs for the web-based expedition coverage that reaches a larger audience. The web statistics show a spike in website hits, nearly doubling from 18K hits in July 2005 to 31K hits in August of the same year during the education cruise. One member of the education team will also be writing personal accounts of this and other expedition experiences for the public-at-large through compelling newspaper stories. These education and outreach activities support the research, monitoring and management of the NWHI by interpreting the research that support the future management of the State of Hawai'i Marine Refuge.

The Sanctuary Sounds project's principle investigator is Cathy Sakas, Acting Superintendent and Education Coordinator of the Gray's Reef National Marine Sanctuary in collaboration with Massachusetts Institute of Technology professor, Cliff Goudey and Dr. Rodney Rountree formerly of the University of Massachusetts. The project's objective is to compile a complete record of natural and man-made underwater and at surface sounds from each of the Nation's 14 marine protected areas managed by the National Marine Sanctuary Program. Over time the recordings for each site will be taken during each distinct season (as feasible). The recordings will then serve as an audio indicator of seasonal activity changes throughout the year. The initial project product will be a library of recordings. This library of recordings can then be used for educational products, serve as research data sets and perhaps even help as a management tool in support of the NWHICRER and State Marine Refuge.

In education and outreach, the recordings will offer multiple opportunities for product development. The first product will be a series of radio messages for use in national and regional public awareness campaigns. The NWHICRER and State educational partners will have the opportunity to use these sounds in support of sanctuary designation and to broaden ocean literacy. Through the use of sounds, listeners feel as if they are at the site being described or are near the vocalizing creature. This approach enables us to bring the State Marine Refuge and the NWHICRER to a broad audience, rather than have them visit and potentially impact the reserve's wildlife and habitats.

Sanctuary Sounds will eventually be incorporated into the websites of each sanctuary and would significantly enhance the visitor's experience. Visitors to facilities such as aquariums and science centers with live video feeds from respective underwater marine protected areas could have a more reality based experience than one without sound. While not presently applicable, underwater and at surface sounds integrated into Geographic Information System programs could offer an innovative and unique opportunity.

- Explain the need for this activity and how it will help to enhance survival or recovery of refuge wildlife and habitats.

Proposed education and outreach activities may not appear to directly impact the survival or recovery of refuge wildlife and habitats, although through enhanced awareness, understanding and appreciation of this special ocean area, there will be more public support for protection for the NWHI for future generations. Broadening ocean literacy through education and outreach informs the public and in turn can provide support for future research and monitoring to assist management priorities.

- Describe how your proposed project can help to better manage the State Marine Refuge.

The State of Hawai'i's Department of Land and Natural Resources Division of Aquatic Resources has a similar mission statement of

<p>13. What types of insurance do you have in place? (attach documentation)</p> <p><input checked="" type="checkbox"/> Wreck Removal</p> <p><input checked="" type="checkbox"/> Pollution</p> <p>NOAA Ship <i>Hi'ialakai</i> is a U.S. Government-owned and -operated research vessel and is self-insured by the United States Government.</p>
<p>14. What certifications/inspections do you have scheduled for your vessel? (attach documentation)</p> <p><input checked="" type="checkbox"/> Rat free      <input checked="" type="checkbox"/> tender vessel      <input checked="" type="checkbox"/> gear/equipment</p> <p><input checked="" type="checkbox"/> Hull inspection      <input checked="" type="checkbox"/> ballast water</p> <ul style="list-style-type: none"> <li>• Rat Free: scheduled with U.S. Dept. of Health and Human Services for April 2006.</li> <li>• Hull Inspection: scheduled with Hawaii Institute of Marine Biology phycologists (normally Scott Godwin) prior to projects working in the NWHI to ensure no nuisance algae species are transported to the NWHI.</li> <li>• Tender Vessel: dive boats, engines, anchor lines, etc. used in the main Hawaiian Islands will be visually inspected for any algal remnants.</li> <li>• Ballast Water: information is transmitted to USCG as required by CFR Title 33, Vol. 2, Parts 151.1500 to 199; IMO Resolution A.868(20); and USCG COMDTPUB P16700.4.</li> <li>• Gear/Equipment: all snorkeling and SCUBA diving gear will be inspected using the following protocols before the research cruise and after each visit to a different island: unzip and open all pockets on BCs, dive bags and wet suits; submerge and soak all dive gear and monitoring gear for a minimum of 24 hours in 100% fresh water; thoroughly dry and then visually inspect, remove and discard all algal pieces all gear prior to departure.</li> </ul>
<p>15. Other permits (list and attach documentation of all other required Federal or State permits).</p> <p>US Fish and Wildlife Service Special Use Permit (pending)</p>
<p>16. Project's relationship to other research projects within the NWHI State Marine Refuge, National Wildlife Refuge, NWHI Coral Reef Ecosystem Reserve, or elsewhere.</p> <p>The NOAA ship <i>Hi'ialakai</i> research cruise to conduct multi-beam mapping, maritime archaeology and education and outreach builds off the successful research and education cruises from previous years. The education and outreach activities requested are building off the innovative August 2005 education cruise, and will support the mission of the NMSP, the NWHICRER and State educational partners to enhance public awareness, understanding, and appreciation of the NWHI.</p>

Section C: Logistics	
17. Time Frame:	
Project Start Date 06/23/2006	Project Completion Date 07/19/2006
Dates actively inside the State Marine Refuge. 06/29/2006 – 07/14/2006	
Personnel schedule in the State Marine Refuge (describe who will be where and when).  The five members of the education and outreach team will work together as one unit, operating off a single dive platform (small boat). The NOAA ship <i>Hi'ialakai</i> will initially transit to Kure Atoll, State Wildlife Refuge and conduct multibeam mapping, maritime archaeology operations and education and outreach observation dives. The ship will then transit to Pearl and Hermes Atoll and commence multibeam	

Captain's Name: CDR Scott Kuester      Chief Scientist or Project Leader: John Rooney (Mapping PI), Hans Van Tilburg (Maritime Heritage PI) and Christina Claire Johnson (Education and Outreach PI)

Vessel Type: Oceanographic Research      Call sign: WTEY

Length: 224 feet      Gross tonnage: 1,914

Port of Embarkation: Honolulu, Hawai'i

Last port vessel will have been at prior to this embarkation: Pago Pago, American Samoa

Total Ballast Water Capacity:      Volume: 487 m3      Total number of tanks on ship: 10

Total Fuel Capacity: 228,642 US gal.      Total number of fuel tanks on ship: 15

Other fuel/chemicals to be carried on board and amounts:

As much as 700 U.S. gal.; lube oil – as much as 10,442 U.S. gal.; numerous other industrial and household chemicals used to operate a 224-foot research vessel.

Number of tenders/skiffs aboard and specific type of motors:

1 each 10 m AMBAR Marine jet boat with Yanmar 370-hp, diesel inboard engine

1 each 8 m AMBAR Marine jet boat with Yanmar 315-hp, diesel inboard engine

2 each 17.5 ft Zodiac inflatable boats, each with one Honda 50-hp, 4-stroke, outboard gasoline engine

1 each 19 ft AMBAR Marine rescue boat with Honda 115-hp, 4-stroke, outboard gasoline engine

Does the vessel have the capability to hold sewage and grey-water? Describe in detail.

The ship has a 4,000 U.S. gal Collection Holding Tank for sewage and grey water. In those waters where effluent may NOT be discharged, sewage and grey water are held in this tank until the ship is in waters where sewage and grey water may be discharged. The ship has a U.S. Coast Guard-approved Marine Sanitation Device (Omnipure model MSD 12 MC) which is used to treat sewage and grey water in those waters where effluent may be discharged.

Does the vessel have a night-time light protocol for use in the NWHI? Describe in detail (attach additional pages as necessary)

(Pending. In communication with ship and CO.)

On what workboats (tenders) will personnel, gear and materials be transported within the State Marine Refuge?

Personnel, gear and materials may be transported within the State Marine Refuge by the ship or any of the 5 ship's small boats listed above or by any program-provided small boat(s) listed above.

How will personnel, gear and materials be transported between ship and shore?

Personnel, gear and materials may be transported between ship and shore by any of the 5 ship's small boats listed above or by any program-provided small boat(s) listed above. The educational day trips to Kure Atoll, State Wildlife Refuge will be orchestrated from a small boat with the support of State Wildlife Refuge Manager, Cynthia Vanderlip. All precautions for eliminating bio-hazards on Kure Atoll, State Wildlife Refuge will be taken.

If applicable, how will personnel be transported between islands within any one atoll?

Personnel, gear and materials may be transported between ship and shore by any of the 5 ship's small boats listed above or by any program-provided small boat(s) listed above.

# CHRISTINA CLAIRE JOHNSON

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**146 Romaine Drive  
Santa Barbara, CA 93105**

**day 805.963.3238 ext. 18  
evening 805.570.1113**

## **Education**

Hawaii Preparatory Academy, Kamuela, Hawaii 1990  
University of Puget Sound, Tacoma, Washington  
University of California, Santa Barbara, B.A., Psychology, December 1995

## **Relevant Experience**

**OSS Group, Inc.**, National Education Liaison for the NOAA National Marine Sanctuary Program  
Coordinate regional and national education and outreach programming for the west coast and Pacific national marine sanctuaries and headquarters; develop and implement education programming, such as the Dive into Education marine science workshop for educators; facilitate regional and national partnerships, such as the JASON Foundation for Education; provide regional support for west coast and Pacific field sites on special projects, such as the LiMPETS network; assist in national and international priorities which include Telepresence and the Dept. of Education for the State of Hawai'i marine science curriculum; and serve on the Education Executive Council to determine and guide the long-term education strategy for the NOAA National Marine Sanctuary Program.

August 2005—Present

Supervisor: Matt Stout, 1305 East-West Highway, Silver Spring, Maryland 20910  
Phone: 301.713.3125 ext. 173

**RS Information Systems, Inc.**, West Coast Education Liaison for the NOAA National Marine Sanctuary Program

Coordinate local, regional and national education and outreach programming for the west coast national marine sanctuaries and headquarters; develop and implement education programming, such as the first annual Dive into Education marine science workshop; facilitate local, regional and national partnerships, such as the MATE Center, and JASON Foundation for Education; provide regional support for west coast field sites on special projects, such as the Channel Islands Argonauts Program and the LiMPETS network; and serve on the Education Executive Council to determine and guide the long-term education strategy for the NOAA National Marine Sanctuary Program.

May 2002—July 2005

Supervisor: Matt Stout, 1305 East-West Highway, Silver Spring, Maryland 20910  
Phone: 301.713.3125 ext. 173

**NOAA, National Ocean Service, Special Projects Office**, Program Specialist

Involved with education and outreach for the Sustainable Seas Expeditions (SSE), provided a support role in setting up the NOAA Technical Review Board to examine manned submersible operations from NOAA vessels and safety issues of concern for SSE. Member of the NOAA support team for President Clinton's Panel on Ocean Exploration; provided recommendations for a U.S. strategy on ocean exploration; Web site development for the panel, agency science advisors, and the interagency task force; worked directly with Panel Members in documenting the strategy; and provided layout designs and concepts for the final report. Project member for The Link Project: Partnerships to Promote Ocean and Space Research and Exploration through Technology Innovation. Duties consist of web development, workshop/symposium design and processes, implementation of project goals and objectives, as well as development of an educational component. Project lead in partnership with the Jason XII Expedition to develop Web-based GIS fly-throughs driven by education content, containing music, narration, a reference map, and still/digital video images. Also provided the initial foundation and preliminary guidance on a education and outreach strategy to NOAA's Office of Ocean Exploration.

March 2000—October 2001

Supervisor: Maureen Warren, 1305 East-West Highway, Silver Spring, Maryland 20910  
Phone: 301.713.3000 ext. 152

**NOAA, National Ocean Service, Sustainable Seas Expeditions (SSE)**, Project Team Leader

**Los Marineros Marine Education Program**, Naturalist

Led tidepool, whale watching, and nature hike excursions for 5<sup>th</sup> graders that encouraged the appreciation of the marine environment; prepared educational materials and conducted presentations at local schools about the marine environment and more precisely the CINMS and the National Marine Sanctuary Program; assisted in the development of a unified message to instill an ocean conservation ethic in the students.

January 1998—June 1998

15 hr/wk

Supervisor: Sheila Cushman, Santa Barbara Museum of Natural History, 2559 Puesta del Sol Road, Santa Barbara, California 93105  
Phone 805.682.4711

**Marine Mammal Center of Santa Barbara**, Volunteer

Participated in the capture, rehabilitation and release of malnourished and entangled wild marine mammals, primarily pinnipeds and some cetaceans; interacted with the general public and related organizations at various public events.

January 1998—June 1998

10 hr/wk

Supervisor: Peter Howorth, 389 North Hope Avenue, Santa Barbara, California 93103  
Phone 805.687.3255

**Dolphin Quest**, Internship

Assisted staff in behavioral training of six Atlantic bottlenose dolphins; was responsible for video recording of interactive encounters with dolphins; educated the public about the marine environment; assisted in the development of education and outreach efforts; also helped trainers collect and process data, specimen samples, and record behavior tendencies.

February 1996

120 hrs

Supervisor: Head Trainers  
Phone 888.437.0486

**National Marine Fisheries Service (NMFS)**, Turtle Tagging Volunteer

Assisted NMFS marine biologists in capturing, containing, securing scientific measurements, tagging, and releasing of endangered Hawaiian green sea turtles.

April 1990

72 hrs

Coordinator: Marc Rice, 65-1692 Kohala Mountain Road, Kamuela, Hawaii 96743  
Phone 808.885.7321

**Special Skills**

- Highly organized, dedicated with a positive attitude
- Ability to cultivate relationships with people of various professional and personal backgrounds
- Japanese language skills
- Speak with poise and confidence in front of groups of people
- Excellent oral and written communication skills
- NAUI SCUBA certification (1990)
- NAUI Dive Rescue certification (1998)
- NAUI Masters certification (1999)
- NOAA Science Diver certification (2001)
- Proficient in numerous software programs, i.e. FileMaker, Excel, Word, PowerPoint, CalendarMaker, PageMaker, PhotoShop, Illustrator, InDesign, AppleWorks, Claris HomePage, Adobe GoLive and ClarisWorks

Vincent Andrew Collins III  
1739 Puowaina St.  
Honolulu, HI 96813

Cell: 808-728-2659  
Home: 808-538-1202  
Email: andy.collins@noaa.gov

## EDUCATION

Highest level completed: Bachelor of Science

High School: Long Beach High School  
Long Beach, NY 11561  
Year Diploma or GED Received: 1985

### Colleges and Universities Attended

State University of New York at Buffalo (UB)  
Buffalo, NY 14260

Total Credits Earned: 80 Semester Credits Quarter Credits  
Major(s): Biology

SUNY College of Environmental Science and Forestry  
Syracuse, NY 13210

Total Credits Earned: 108 Semester Credits Quarter Credits  
Major(s): Resource Management / Environmental and Forest  
Biology  
Degree: Bachelor of Science 1991

## Other Qualifications

### Job Related Training:

7/2004 Video editing with Final Cut Pro (3 days)

12/2001 Science of Oil Spills (SOS)

7/2001 - 12/2001 (6 months): CISCO Network Training Academy; CCNA Curriculum  
Semesters 1-4. Computer networking, network protocols, routing, Local Area  
Network, Wide Area Network design, TCP/IP Troubleshooting, network cabling.  
Completed.

2000 (2 days): Troubleshooting the Apple Macintosh; Apple Macintosh troubleshooting,  
basic Mac server configuration, Mac networking.

2000 (5 days): CITRIX Metaframe Administration; Remote access solutions.

## WORK EXPERIENCE

11/2001 To Present

Designed, programmed, and administer a large and complex Department website. This involves coordination among all the various agencies within DLNR, other State and Federal agencies, and local groups. I coordinate all ecommerce activities of the department, including any online services such as the sale of fishing and hunting licenses. As the department webmaster I am responsible for reformatting and re-writing technical and scientific information, press releases, and other information for web viewing. I prepare the information in such a way as to be accessible by the widest audience possible, both national and international, including disabled web users. Designed web pages and web exhibits pertaining to the Northwestern Hawaiian Islands and was actively involved in publishing to the web information from the latest research expedition to the area. For these projects I actively researched and consulted with experts on the biological, cultural and historic aspects of the NWHI.

Support 250+ users on Mac and PC platforms and administer eight Netware servers, three Windows servers, and three CITRIX Servers for remote access. Resolve operating system issues, and diagnose server accessibility issues on the LAN. Provide network installation support (Local Area Network (LAN) support), LAN server access, and email support (Lotus Notes, cc:Mail, and MS Outlook). Database administrator for two SQL 2000 database servers.

Directly responsible for computer and information technology (IT) related equipment purchases for the entire department. Develop project proposals and requests for quotations for any IT purchases and services we decide to outsource. Responsible for reviewing bids, quotations and proposals from outside vendors and awarding contracts. Write and develop department-wide policies related to IT security, email usage, WWW usage, computer usage, and web page design.

Troubleshoot network issues and analyze server performance on diverse Ethernet networks that run multiple protocols - TCP/IP, AppleTalk, IPX/SPX. Designed and implemented additions to our current LAN, including WAN links. Re-addressed entire TCP/IP LAN.

I develop and administer databases in MS Access 97/2000. Designed and built DLNR's Intranet portal and our Personnel Information System that runs on a RedHat Linux 7/Apache webserver and is coded using PERL.

Responsible for monitoring and troubleshooting our department's wide area links (WAN) to remote offices and to the Internet. This includes HTTP, FTP, DNS and Telnet access issues.

Actively involved in training the Department staff on computer and network usage, computer virus avoidance, software usage and website development. Trained office personnel in the use of FTP, Telnet and website development programs such as MS FrontPage and Macromedia Dreamweaver. All of my duties with DLNR require me to work independently and prioritize my work with little or no supervision.

09/1997 To 05/1999

Project Manager

Salary \$ 30000.00 per Year

Hours: 40 hours/week

Busch Consulting, Inc.

2346 Round Top Dr., Honolulu, HI 96822

I was responsible for interacting with the public to explain the exhibit and aiding young adult visitors with the hands-on invertebrate display. I received training in native coral reef flora and fauna ID along with tools for educating and interacting with the public in a exhibit setting.

01/1995 To 07/1996

Peace Corps Volunteer - Nepal

Salary: \$ 125.00 per month

Hours: 40 hours/week

Employer Name

U.S. Govt. Peace Corps

Employer Address

The Paul D. Coverdell Peace Corps Headquarters, 1111 20th Street NW,  
Washington, D.C., 20526

Supervisor's Name      Supervisor's Phone Number

Renee Thakali 8004248580

I was a Community Forestry Volunteer in Okhaldhunga, Nepal. My main job was to provide support to the regional forest office in Okhaldhunga District. I helped village forest user groups (FUGs) to develop five year management plans for their forest areas so that the Government of Nepal could return management back to local groups. During my tenure I helped to develop ten of these management plans and participated in three management activities. Working with the villagers of Nepal, who were often of different cultural groups themselves, taught me how to build consensus among parties from different cultural backgrounds.

I also helped in training FUG members in forest management practices and larger scale ecosystem principles such as how healthy forests help to provide clean water and prevent soil erosion.

My experience in Nepal helped me learn how to relate to and work with people of different cultural and ethnic backgrounds. It also greatly increased my appreciation of the many different ways the same issue can be viewed and the importance cultural biases have.

I also completed a 20,000 HA survey for a commercially significant shrub used in paper production.

As a side project I developed plans for and secured funding for addition of two new rooms to one of the local elementary schools.

02/1992      To 01/1995

Implementation Specialist

Salary : \$ 16800.00 per year

Hours: 40 hours/wk

Employer Name



## RESUME

**Cathy J. Sakas, Education Coordinator**  
**NOAA's Gray's Reef National Marine Sanctuary**  
**10 Ocean Science Circle**  
**Savannah, Georgia 31411**  
**Office Telephone Number: 912-598-2417**  
**Office Facsimile Number: 912-598-2367**  
**<Cathy.Sakas@noaa.gov>**

### EDUCATION:

- \*M.Ed. Science; 1989; Armstrong-Atlantic State University; Savannah, GA
- \*Teacher Certification for Biology 9 – 12 Grades 1989; Armstrong-Atlantic State University; Savannah, GA
- \*B.S. Biology; 1976; Armstrong-Atlantic State University; Savannah, GA

### EMPLOYMENT HISTORY:

- \*October 1998 to present – Education Coordinator; NOAA's Gray's Reef National Marine Sanctuary (GRNMS); Savannah, GA.

#### Accomplishments:

- Project Manager and Writer of Gray's Reef Ocean Science Course
- Originator and manager of Gray's Reef Student Ocean Council began in October of 1999
- Distance Learning Programs on various subjects since October of 1998 presented to over 5000 students to date
- Coordinated 15 workshops for educators to date; in 2004 with National Geographic Society
- Coordinator of National Marine Sanctuary Program's (NMSP) Dive into Education 2005 Educator's Workshop
- Managed GRNMS entry for National Marine Sanctuary Foundation's web based reference Sanctuary Encyclopedia in 2004
- Programs presented annually at NMEA, GAME, NSTA, GSTA conferences
- Created radio messages and managed radio outreach program (2000 – 2005)
- Principal Investigator of *Sanctuary Sounds*, NMSP education mini grant 2004
- Principal Investigator of *Distance Learning Program*, NMSP education mini grant 2005
- NOAA certified Scientific Diver since June 1999
- Aquanaut – 9 day mission from Aquarius Habitat, Sept. 11 - 19, 2001
- Submersible Pilot of DeepWorker 2000; several missions completed 1999 - 2001
- Member of SECOSSEE Education Advisory Panel since October 2002
- Vice Chair of SAMFC Education and Information Advisory Panel since May 2003
- Facilitator, SEUSIT for North Atlantic Right Whales Education and Outreach Committee since November 2005

- \*January 2002 to December 2004 – Host of *The Natural South*; Turner South; Atlanta, GA – (series of environmental issues germane to the southeastern USA)

#### Accomplishments:

- Sixty six total programs to date
- Programs currently airing as reruns through 2008

**BOARD AND PANEL MEMBERSHIPS:**

- \*May 2003 to Present – Vice Chair and Member; Education Advisory Panel of the South Atlantic Fisheries Management Council; Charleston, South Carolina
- \*October 2002 to Present – Member, Advisory Panel of Southeastern Center for Ocean Science Education Excellence (SECOSEE)
- \*October 2001 to Present – Member; Georgia Coastal Education Group (President, 2001 to 2003); Coastal Georgia
- \*October 1998 to Present – Board of Directors; Tybee Island Marine Science Foundation; Tybee Island, Georgia – (Vice President, 2001- 2002; President, 2002 - 2005; Vice President 2005 – 2007)
- \*1978 to Present - Board of Directors; Wilderness Southeast, Inc.; Savannah, GA - (President, 1984 to 1989 and 1993 to 1996)

**ACCOMPLISHMENTS, AWARDS AND HONORS:**

- \*September 2001 – Aquanaut; Certified during Aquarius Mission #2001-06; nine day mission spent entirely underwater with up to seven hours of diving made from Aquarius Habitat each day
- \*June 1999 to present – NOAA Certified Scientific Diver
- \*November 1998 to Present – Certified Submersible Pilot for DeepWorker 2000; certified to 500'
- \*April 1995 - Special Conservation Achievement Award; Georgia Wildlife Federation

**Autonomous Underwater Listening Station (AULS) Description:**

Autonomous Underwater Listening Stations (AULS) were developed by the MIT Sea Grant Center for Fisheries Engineering Research as part of a project funded by the Northeast Consortium (<http://www.northeastconsortium.org/>). The project, "The Identification of Cod and Haddock Spawning Habitat Using Passive Acoustics", is cooperative research with the fishing industry aimed at helping manage these two important species.

With a restrictive budget and a lot of bottom to cover, we opted for a low-cost approach that exploited the amazingly capable consumer electronics products that are available today.

For reasons not fully understood, society has a need to carry around vast amounts of recorded music to satisfy and unpredictable yearning for specific songs. This spawned the now ubiquitous MP3 player.

One manufacturer, Creative Laboratories, (<http://www.creaf.com/>) has a product with the unusual ability to record from a real-time source rather than file transfers from a computer connection. The Nomad Jukebox, the heart of the AULS, is the size of a pocket CD player but holds a 10 GB hard drive. When combined with an adequate battery pack, the unit provides nearly 60 hours of uninterrupted recording.

In this manual we offer what we have learned in our seven months of using AULS. We anticipate learning more in our project work and we hope to learn more from you as you begin to employ them to listen to the secrets of the deep.

Our deployments have been in coastal waters, mostly from 50 to 100 m deep. Set from fishing boats, we rig them like passive fishing gear on a ground line between two anchors and two buoys. There are other methods of deployment and indeed, for some applications, simply lowering a hydrophone on a cable extension can work just fine.

Figure 1 is the AULS unit in its galvanized steel bottom mount. This weldment has provided sufficient weight to keep our units in place during our Gulf or Maine deployments.

Figure 1. AULS in its steel bottom mount.

**AULS Specifications:****Dimensions:**

Galvanized steel bottom mount	18" x 18" x 18"
Total weight	80 lbs.
Pressure housing	9" dia. X 10" high.
Depth limit	Not to exceed 300 feet of sea water
Transducer specs	-167 dB re:1V/ Pa
Nomad specs	Frequency Response: 20 Hz~20,000 Hz Harmonic Distortion: <0.1% Signal to Noise: >90 dB
Battery performance	Approximately 60 hours of recording

**Operation:**

Pressure housing – opening and closing – the AULS pressure housing is designed with a face seal that relies on water pressure and the action of the grooved band clamp to maintain a watertight O-ring seal. As a result, the pre-loading of the band clamp is essential to the integrity of the housing when it first goes into the water.

We have found that the band clamp should be tightened to expose approximately 3/4" of thread beyond the nut. Any less is inviting leakage of saltwater into the housing and risks the loss of all enclosed components.

The integrity of the housing is also dependent on the O-ring and its contact surfaces. Keep the O-ring lubricated with Parker O-Lube (supplied) and keep it and the contact surfaces free of dirt. Replace the O-ring if it gets cut or damaged (supplied). Protect the mating surface of the lower housing during handling and battery replacement. The polyethylene material is easily scratched.

**Internal components:**

Inside the pressure housing is the Nomad recorder, a 6 Volt gel cell battery pack, and a DC/DC converter and filter module. The Battery pack is held in position by four threaded stand-offs that support a PVC mounting plate. The Nomad is mounted to this plate with Velcro. The converter/filter module is mounted to the inside of the top housing with Velcro. Figure 4 is a block diagram of these components.

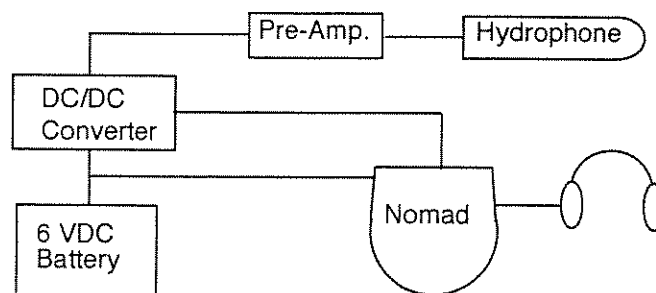
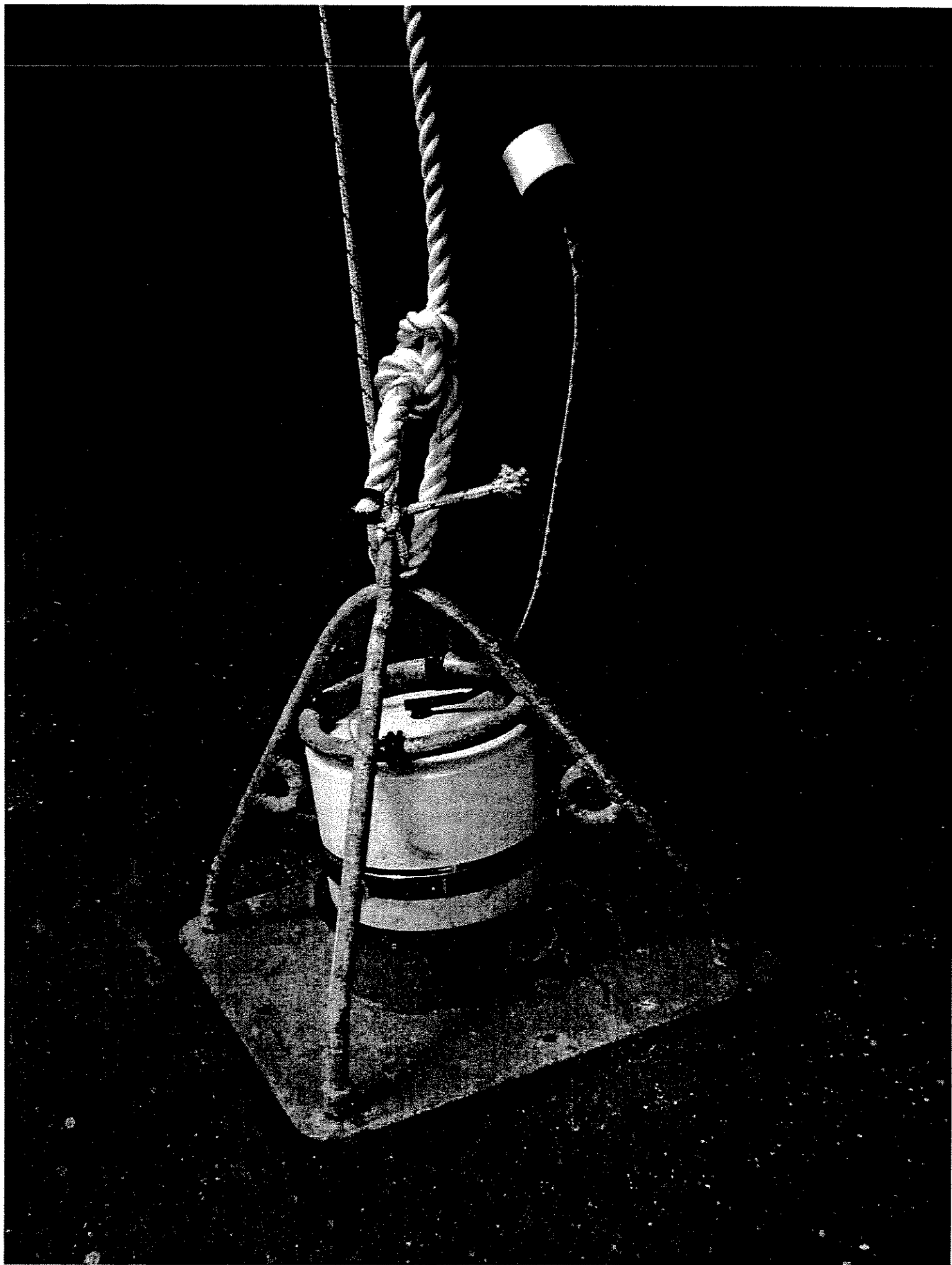
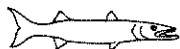


Figure 4. AULS Block diagram





## Reef Environmental Education Foundation

Technical support provided by: Hawaii Coral Reef Network • Project S.E.A.-Link •  
Maui Community College, Marine Option Program • Division of Aquatic Resources,  
Hawaii Dept. of Land and Natural Resources

For more information on REEF, its Survey  
Project or to view data, visit [www.reef.org](http://www.reef.org).

## MEMBER ID AND MAILING ADDRESS

If you have a REEF number, fill it in. You need only fill in your address if it has changed. If you don't have a REEF number or have lost it, fill in the appropriate oval and fill in your address.

Return completed forms to: Reef Environmental Education Foundation (REEF)  
P.O. Box 246 Key Largo, FL USA 33037

- ☐ Change of Name/Address  
☐ New Member  
☐ Lost ID Number

MEMBER ID									
0	0	0	0	0	0				
1	1	1	1	1	1				
2	2	2	2	2	2				
3	3	3	3	3	3				
4	4	4	4	4	4				
5	5	5	5	5	5				
6	6	6	6	6	6				
7	7	7	7	7	7				
8	8	8	8	8	8				
9	9	9	9	9	9				

First Name

MI

Last Name

Street Address

City

State/Province

Country

Zip/Postal Code

Phone Number

E-Mail

## SURVEY TYPE

Fill in the type of survey being taken:

- ☐ Species & Abundance  
☐ Species Only

A Species and Abundance survey is taken on a single dive and records the species positively identified as well as their abundance. A Species Only survey may be taken over multiple dives and records the species positively identified (by marking the Single bubble for these species).

## GEOGRAPHIC ZONE CODE

In the grid below, fill in as many digits as possible of the zone code for the location in which the survey was taken using the numbers on the REEF Geographic Code List (see [www.reef.org](http://www.reef.org) or contact REEF).

Enter first digit

0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

## NAVIGATIONAL COORDINATES

Fill in this section if you have the exact latitude and longitude to the minute or hundredth of a minute. Please do not use LORAN coordinates.

LATITUDE - N

LONGITUDE - W

DEG	MIN	/100
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

DEG	MIN	/100
1		
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

## DIVE SITE

Island

Print the local name of the dive site and area below.



PLEASE DO NOT WRITE IN THIS SHADED AREA

13771

- For each species sighted, be sure to only fill in one abundance category bubble.

CORRECT MARK



- Only use No. 2 pencil.
- Do not use a pencil that has been underwater.
- Darken the oval completely.
- Erase cleanly any marks that you change.
- Please enter information on the front and back of the form as complete as possible.
- Only report species that you have positively identified.
- Species marked with an "E" are endemic to Hawaiian reefs.
- The Genus species abbreviation is given with the common name.

Abundance codes:

- (S) Single = 1  
(F) Few = 2 - 10  
(M) Many = 11 - 100  
(A) Abundant = > 100

Please return completed form to:  
REEF, P.O. Box 246  
Key Largo, FL 33037 USA  
Questions? Contact data@reef.org

Please consult the REEF Webpage for a complete list of scientific and Hawaiian names.

## ANGELFISH

- (S) (F) (M) (A) Bandit Angelfish (*H. arcuatus*) E  
(S) (F) (M) (A) Fisher's Angelfish (*C. fisheri*) E  
(S) (F) (M) (A) Masked Angelfish (*G. personatus*) E  
(S) (F) (M) (A) Potter's Angelfish (*C. potteri*) E

## ANTHIAS

- (S) (F) (M) (A) Bicolor Anthias (*P. bicolor*)  
(S) (F) (M) (A) Hawaiian Longfin Anthias (*P. hawaiiensis*) E  
(S) (F) (M) (A) Thompson's Anthias (*P. thompsoni*)

## BARRACUDA

- (S) (F) (M) (A) Great Barracuda (*S. barracuda*)  
(S) (F) (M) (A) Heller's Barracuda (*S. helleri*)

## BIGEYE

- (S) (F) (M) (A) Glasseye (*H. cruentatus*)  
(S) (F) (M) (A) Hawaiian Bigeye (*P. meeki*) E

## BLENNY

- (S) (F) (M) (A) Ewa Fangblenny (*P. ewaensis*) E  
(S) (F) (M) (A) Gargantuan Blenny (*C. obscurus*) E  
(S) (F) (M) (A) Gosline's Fangblenny (*P. goslinei*) E  
(S) (F) (M) (A) Scarface Blenny (*C. vanderbilti*) E  
(S) (F) (M) (A) Shortbodied Blenny (*E. brevis*)  
(S) (F) (M) (A) Zebra Rockskipper (*I. zebra*) E

## BONEFISH AND LADYFISH

- (S) (F) (M) (A) Bonefish sp. (*Albula* sp.)  
(S) (F) (M) (A) Hawaiian Tenpounder (*E. hawaiiensis*)

## BOXFISH

- (S) (F) (M) (A) Spotted Boxfish (*O. meleagris*)  
(S) (F) (M) (A) Thornback Cowfish (*L. fornasini*)  
(S) (F) (M) (A) Whitley's Boxfish (*O. whitleyi*)

## BUTTERFLYFISH

- (S) (F) (M) (A) Blacklip Butterflyfish (*C. kleinii*)  
(S) (F) (M) (A) Bluestripe Butterflyfish (*C. fremblii*) E  
(S) (F) (M) (A) Forcepsfish (*F. flavissimus*)  
(S) (F) (M) (A) Fourspot Butterflyfish (*C. quadrimaculatus*)  
(S) (F) (M) (A) Lined Butterflyfish (*C. lineolatus*)  
(S) (F) (M) (A) Milletseed Butterflyfish (*C. miliaris*) E  
(S) (F) (M) (A) Multiband Butterflyfish (*C. multinctus*) E  
(S) (F) (M) (A) Ornate Butterflyfish (*C. ornatissimus*)  
(S) (F) (M) (A) Oval Butterflyfish (*C. lunulatus*)  
(S) (F) (M) (A) Pennantfish (*H. diphreutes*)  
(S) (F) (M) (A) Pyramid Butterflyfish (*H. polyepis*)  
(S) (F) (M) (A) Raccoon Butterflyfish (*C. lunula*)  
(S) (F) (M) (A) Reticulated Butterflyfish (*C. reticulatus*)  
(S) (F) (M) (A) Saddleback Butterflyfish (*C. ephippium*)  
(S) (F) (M) (A) Teardrop Butterflyfish (*C. unimaculatus*)  
(S) (F) (M) (A) Threadfin Butterflyfish (*C. auriga*)  
(S) (F) (M) (A) Thompson's Butterflyfish (*H. thompsoni*)

## CARDINALFISH

- (S) (F) (M) (A) Bandfin Cardinalfish (*A. menesemus*)  
(S) (F) (M) (A) Iridescent Cardinalfish (*A. kallopterus*)  
(S) (F) (M) (A) Spotted Cardinalfish (*A. maculiferus*) E

## DAMSELFISH

- (S) (F) (M) (A) Agile Chromis (*C. agilis*)  
(S) (F) (M) (A) Blackfin Chromis (*C. vanderbilti*)  
(S) (F) (M) (A) Blackspot Sergeant (*A. sordidus*)  
(S) (F) (M) (A) Blue-eye Damselfish (*P. johnstonianus*)  
(S) (F) (M) (A) Brighteye Damselfish (*P. imparipennis*)  
(S) (F) (M) (A) Chocolate Dip Damselfish (*C. hanui*) E  
(S) (F) (M) (A) Hawaiian Dascyllus (*D. albisella*) E  
(S) (F) (M) (A) Hawaiian Sergeant (*A. abdominalis*) E  
(S) (F) (M) (A) Indo-Pacific Sergeant (*A. vaigiensis*)  
(S) (F) (M) (A) Oval Chromis (*C. ovals*) E  
(S) (F) (M) (A) Pacific Gregory (*S. fasciolatus*)  
(S) (F) (M) (A) Rock Damselfish (*P. sindonis*) E  
(S) (F) (M) (A) Threespot Chromis (*C. verater*) E  
(S) (F) (M) (A) Whitetail Chromis (*C. leucura*)

## DARTFISH AND WORMFISH

- (S) (F) (M) (A) Curious Wormfish (*G. curiosus*)  
(S) (F) (M) (A) Fire Dartfish (*N. magnifica*)  
(S) (F) (M) (A) Spottail Dartfish (*P. heteroptera*)

## EEL

- (S) (F) (M) (A) Banded Moray (*G. rueppelliae*)  
(S) (F) (M) (A) Dragon Moray (*E. pardalis*)  
(S) (F) (M) (A) Dwarf Moray (*G. melatremus*)  
(S) (F) (M) (A) Hawaiian Garden Eel (*G. hawaiiensis*)  
(S) (F) (M) (A) Snowflake Moray (*E. nebulosa*)  
(S) (F) (M) (A) Stout Moray (*G. eurostus*)  
(S) (F) (M) (A) Tiger Moray (*S. tigrina*)  
(S) (F) (M) (A) Undulated Moray (*G. undulatus*)  
(S) (F) (M) (A) Viper Moray (*E. canina*)  
(S) (F) (M) (A) Whitemouth Moray (*G. meleagris*)  
(S) (F) (M) (A) Yellowmargin Moray (*G. flavimarginatus*)  
(S) (F) (M) (A) Zebra Moray (*G. zebra*)

## FILEFISH

- (S) (F) (M) (A) Barred Filefish (*C. dumerilii*)  
(S) (F) (M) (A) Fantail Filefish (*P. spilosome*) E  
(S) (F) (M) (A) Scrawled Filefish (*A. scriptus*)  
(S) (F) (M) (A) Squaretail Filefish (*C. sandwichiensis*) E  
(S) (F) (M) (A) Yellowtail Filefish (*P. aspricaudus*)

## FLOUNDER

- (S) (F) (M) (A) Flowery Flounder (*B. mancus*)  
(S) (F) (M) (A) Panther Flounder (*B. pantherinus*)

## GOATFISH

- (S) (F) (M) (A) Bandtail Goatfish (*U. arge*)  
(S) (F) (M) (A) Blue Goatfish (*P. cyclostomus*)  
(S) (F) (M) (A) Doublebar Goatfish (*P. bifasciatus*)  
(S) (F) (M) (A) Manybar Goatfish (*P. multifasciatus*)  
(S) (F) (M) (A) Sidespot Goatfish (*P. pleurostigma*)  
(S) (F) (M) (A) Whitesaddle Goatfish (*P. porphyreus*) E  
(S) (F) (M) (A) Yellowfin Goatfish (*M. vanicolensis*)  
(S) (F) (M) (A) Yellowstripe Goatfish (*M. flavolineatus*)

## GROUPE (SEABASS)

- (S) (F) (M) (A) Hawaiian (Black) Grouper (*E. quernus*) E  
(S) (F) (M) (A) Peacock Grouper (*C. argus*)

<table> <tr><td colspan="2"><b>HAWKFISH</b></td></tr> <tr><td>(S F M A)</td><td>Arc-Eye Hawkfish (<i>P. arcatus</i>)</td></tr> <tr><td>(S F M A)</td><td>Blackside Hawkfish (<i>P. forsteri</i>)</td></tr> <tr><td>(S F M A)</td><td>Redbarred Hawkfish (<i>C. fasciatus</i>)</td></tr> <tr><td>(S F M A)</td><td>Stocky Hawkfish (<i>C. pinnulatus</i>)</td></tr> <tr><td colspan="2"><b>JACK</b></td></tr> <tr><td>(S F M A)</td><td>Bigeye Scad (<i>S. crumenophthalmus</i>)</td></tr> <tr><td>(S F M A)</td><td>Bluefin Trevally (<i>C. melampygus</i>)</td></tr> <tr><td>(S F M A)</td><td>Giant Trevally (<i>C. ignobilis</i>)</td></tr> <tr><td>(S F M A)</td><td>Golden Trevally (<i>G. speciosus</i>)</td></tr> <tr><td>(S F M A)</td><td>Leatherback (<i>S. lysan</i>)</td></tr> <tr><td>(S F M A)</td><td>Mackerel Scad (<i>D. macarellus</i>)</td></tr> <tr><td>(S F M A)</td><td>Rainbow Runner (<i>E. bipinnulata</i>)</td></tr> <tr><td colspan="2"><b>LONGFISH</b></td></tr> <tr><td>(S F M A)</td><td>Bluestriped Pipefish (<i>D. exisus</i>)</td></tr> <tr><td>(S F M A)</td><td>Cornetfish (<i>F. commersonii</i>)</td></tr> <tr><td>(S F M A)</td><td>Halfbeak sp. (<i>Hemiramphus</i> sp.)</td></tr> <tr><td>(S F M A)</td><td>Houndfish (<i>T. crocodilus</i>)</td></tr> <tr><td>(S F M A)</td><td>Keeltail Needlefish (<i>P. argalus</i>)</td></tr> <tr><td>(S F M A)</td><td>Redstripe Pipefish (<i>D. baldwini</i>)</td></tr> <tr><td>(S F M A)</td><td>Trumpetfish (<i>A. chinensis</i>)</td></tr> <tr><td colspan="2"><b>MULLET and THREADFIN</b></td></tr> <tr><td>(S F M A)</td><td>Sharpnose Mullet (<i>N. leuciscus</i>)</td></tr> <tr><td>(S F M A)</td><td>Six-Fingered (Moi) Threadfin (<i>P. sexfilis</i>)</td></tr> <tr><td>(S F M A)</td><td>Striped Mullet (<i>M. cephalus</i>)</td></tr> <tr><td colspan="2"><b>PARROTFISH</b></td></tr> <tr><td>(S F M A)</td><td>Bullethead Parrotfish (<i>C. sordidus</i>)</td></tr> <tr><td>(S F M A)</td><td>Palenose Parrotfish (<i>S. psittacus</i>)</td></tr> <tr><td>(S F M A)</td><td>Redlip Parrotfish (<i>S. rubroviolaceus</i>)</td></tr> <tr><td>(S F M A)</td><td>Spectacled Parrotfish (<i>C. perspicillatus</i>) E</td></tr> <tr><td>(S F M A)</td><td>Stareye Parrotfish (<i>C. carolinus</i>)</td></tr> <tr><td colspan="2"><b>PUFFERFISH</b></td></tr> <tr><td>(S F M A)</td><td>Ambon Toby (<i>C. amboinensis</i>)</td></tr> <tr><td>(S F M A)</td><td>Crown Toby (<i>C. coronata</i>)</td></tr> <tr><td>(S F M A)</td><td>Hawaiian Whitespotted Toby (<i>C. jactator</i>) E</td></tr> <tr><td>(S F M A)</td><td>Lantern Toby (<i>C. epilampra</i>)</td></tr> <tr><td>(S F M A)</td><td>Maze Toby (<i>C. rivulata</i>)</td></tr> <tr><td>(S F M A)</td><td>Porcupinefish (<i>D. hystrix</i>)</td></tr> <tr><td>(S F M A)</td><td>Spiny Balloonfish (<i>D. holocanthus</i>)</td></tr> <tr><td>(S F M A)</td><td>Spotted Puffer (<i>A. meleagris</i>)</td></tr> <tr><td>(S F M A)</td><td>Stripebelly Puffer (<i>A. hispidus</i>)</td></tr> <tr><td colspan="2"><b>RAY</b></td></tr> <tr><td>(S F M A)</td><td>Broad Stringray (<i>D. latus</i>)</td></tr> <tr><td>(S F M A)</td><td>Manta Ray (<i>M. birostris</i>)</td></tr> <tr><td>(S F M A)</td><td>Spotted Eagle Ray (<i>A. narinari</i>)</td></tr> <tr><td colspan="2"><b>SCORPIONFISH</b></td></tr> <tr><td>(S F M A)</td><td>Devil Scorpionfish (<i>S. diabolus</i>)</td></tr> <tr><td>(S F M A)</td><td>Hawaiian Lionfish (<i>D. barberi</i>) E</td></tr> <tr><td>(S F M A)</td><td>Hawaiian Turkeyfish (<i>P. sphex</i>) E</td></tr> <tr><td>(S F M A)</td><td>Leaf Scorpionfish (<i>T. triacanthus</i>)</td></tr> <tr><td>(S F M A)</td><td>Titan Scorpionfish (<i>S. cacopsis</i>) E</td></tr> <tr><td colspan="2"><b>SHARK</b></td></tr> <tr><td>(S F M A)</td><td>Blacktip Reef Shark (<i>C. melanopterus</i>)</td></tr> <tr><td>(S F M A)</td><td>Gray Reef Shark (<i>C. amblyrhynchus</i>)</td></tr> <tr><td>(S F M A)</td><td>Whitetip Reef Shark (<i>T. obesus</i>)</td></tr> <tr><td colspan="2"><b>SNAPPER and EMPEROR</b></td></tr> <tr><td>(S F M A)</td><td>Bigeye Emperor (<i>M. grandoculis</i>)</td></tr> <tr><td>(S F M A)</td><td>Blacktail Snapper (<i>L. fulvus</i>)</td></tr> <tr><td>(S F M A)</td><td>Bluestripe Snapper (<i>L. kasmira</i>)</td></tr> <tr><td>(S F M A)</td><td>Green Jobfish (Gray Snapper) (<i>A. virescens</i>)</td></tr> <tr><td>(S F M A)</td><td>Smalltooth Jobfish (Forktail Snapper) (<i>A. furca</i>)</td></tr> <tr><td colspan="2"><b>SQUIRRELFISH</b></td></tr> <tr><td>(S F M A)</td><td>Bigscale Soldierfish (<i>M. berndti</i>)</td></tr> <tr><td>(S F M A)</td><td>Crown Squirrelfish (<i>S. diadema</i>)</td></tr> <tr><td>(S F M A)</td><td>Epaulette Soldierfish (<i>M. kuntee</i>)</td></tr> <tr><td>(S F M A)</td><td>Hawaiian Squirrelfish (<i>S. xantherythrum</i>) E</td></tr> </table>	<b>HAWKFISH</b>		(S F M A)	Arc-Eye Hawkfish ( <i>P. arcatus</i> )	(S F M A)	Blackside Hawkfish ( <i>P. forsteri</i> )	(S F M A)	Redbarred Hawkfish ( <i>C. fasciatus</i> )	(S F M A)	Stocky Hawkfish ( <i>C. pinnulatus</i> )	<b>JACK</b>		(S F M A)	Bigeye Scad ( <i>S. crumenophthalmus</i> )	(S F M A)	Bluefin Trevally ( <i>C. melampygus</i> )	(S F M A)	Giant Trevally ( <i>C. ignobilis</i> )	(S F M A)	Golden Trevally ( <i>G. speciosus</i> )	(S F M A)	Leatherback ( <i>S. lysan</i> )	(S F M A)	Mackerel Scad ( <i>D. macarellus</i> )	(S F M A)	Rainbow Runner ( <i>E. bipinnulata</i> )	<b>LONGFISH</b>		(S F M A)	Bluestriped Pipefish ( <i>D. exisus</i> )	(S F M A)	Cornetfish ( <i>F. commersonii</i> )	(S F M A)	Halfbeak sp. ( <i>Hemiramphus</i> sp.)	(S F M A)	Houndfish ( <i>T. crocodilus</i> )	(S F M A)	Keeltail Needlefish ( <i>P. argalus</i> )	(S F M A)	Redstripe Pipefish ( <i>D. baldwini</i> )	(S F M A)	Trumpetfish ( <i>A. chinensis</i> )	<b>MULLET and THREADFIN</b>		(S F M A)	Sharpnose Mullet ( <i>N. leuciscus</i> )	(S F M A)	Six-Fingered (Moi) Threadfin ( <i>P. sexfilis</i> )	(S F M A)	Striped Mullet ( <i>M. cephalus</i> )	<b>PARROTFISH</b>		(S F M A)	Bullethead Parrotfish ( <i>C. sordidus</i> )	(S F M A)	Palenose Parrotfish ( <i>S. psittacus</i> )	(S F M A)	Redlip Parrotfish ( <i>S. rubroviolaceus</i> )	(S F M A)	Spectacled Parrotfish ( <i>C. perspicillatus</i> ) E	(S F M A)	Stareye Parrotfish ( <i>C. carolinus</i> )	<b>PUFFERFISH</b>		(S F M A)	Ambon Toby ( <i>C. amboinensis</i> )	(S F M A)	Crown Toby ( <i>C. coronata</i> )	(S F M A)	Hawaiian Whitespotted Toby ( <i>C. jactator</i> ) E	(S F M A)	Lantern Toby ( <i>C. epilampra</i> )	(S F M A)	Maze Toby ( <i>C. rivulata</i> )	(S F M A)	Porcupinefish ( <i>D. hystrix</i> )	(S F M A)	Spiny Balloonfish ( <i>D. holocanthus</i> )	(S F M A)	Spotted Puffer ( <i>A. meleagris</i> )	(S F M A)	Stripebelly Puffer ( <i>A. hispidus</i> )	<b>RAY</b>		(S F M A)	Broad Stringray ( <i>D. latus</i> )	(S F M A)	Manta Ray ( <i>M. birostris</i> )	(S F M A)	Spotted Eagle Ray ( <i>A. narinari</i> )	<b>SCORPIONFISH</b>		(S F M A)	Devil Scorpionfish ( <i>S. diabolus</i> )	(S F M A)	Hawaiian Lionfish ( <i>D. barberi</i> ) E	(S F M A)	Hawaiian Turkeyfish ( <i>P. sphex</i> ) E	(S F M A)	Leaf Scorpionfish ( <i>T. triacanthus</i> )	(S F M A)	Titan Scorpionfish ( <i>S. cacopsis</i> ) E	<b>SHARK</b>		(S F M A)	Blacktip Reef Shark ( <i>C. melanopterus</i> )	(S F M A)	Gray Reef Shark ( <i>C. amblyrhynchus</i> )	(S F M A)	Whitetip Reef Shark ( <i>T. obesus</i> )	<b>SNAPPER and EMPEROR</b>		(S F M A)	Bigeye Emperor ( <i>M. grandoculis</i> )	(S F M A)	Blacktail Snapper ( <i>L. fulvus</i> )	(S F M A)	Bluestripe Snapper ( <i>L. kasmira</i> )	(S F M A)	Green Jobfish (Gray Snapper) ( <i>A. virescens</i> )	(S F M A)	Smalltooth Jobfish (Forktail Snapper) ( <i>A. furca</i> )	<b>SQUIRRELFISH</b>		(S F M A)	Bigscale Soldierfish ( <i>M. berndti</i> )	(S F M A)	Crown Squirrelfish ( <i>S. diadema</i> )	(S F M A)	Epaulette Soldierfish ( <i>M. kuntee</i> )	(S F M A)	Hawaiian Squirrelfish ( <i>S. xantherythrum</i> ) E	<table> <tr><td colspan="2"><b>SURGEONFISH</b></td></tr> <tr><td>(S F M A)</td><td>Achilles Tang (<i>A. achilles</i>)</td></tr> <tr><td>(S F M A)</td><td>Black Surgeonfish (<i>C. hawaiiensis</i>)</td></tr> <tr><td>(S F M A)</td><td>Bluelined Surgeonfish (<i>A. nigroris</i>)</td></tr> <tr><td>(S F M A)</td><td>Brown Surgeonfish (<i>A. nigrofuscus</i>)</td></tr> <tr><td>(S F M A)</td><td>Convict Tang (<i>A. triostegus</i>)</td></tr> <tr><td>(S F M A)</td><td>Eyestripe Surgeonfish (<i>A. dussumieri</i>)</td></tr> <tr><td>(S F M A)</td><td>Golding Surgeonfish (<i>C. strigosus</i>)</td></tr> <tr><td>(S F M A)</td><td>Orangeband Surgeonfish (<i>A. olivaceus</i>)</td></tr> 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<tr><td>(S F M A)</td><td>Psychedelic Wrasse (<i>A. chrysocephalus</i>) E</td></tr> <tr><td>(S F M A)</td><td>Ringtail Wrasse (<i>O. unifasciatus</i>)</td></tr> <tr><td>(S F M A)</td><td>Rockmover Wrasse (<i>N. taeniurus</i>)</td></tr> <tr><td>(S F M A)</td><td>Saddle Wrasse (<i>T. duperrey</i>) E</td></tr> <tr><td>(S F M A)</td><td>Shortnose Wrasse (<i>M. geoffroy</i>) E</td></tr> <tr><td>(S F M A)</td><td>Smalltail (Pencil) Wrasse (<i>P. cerasinus</i>)</td></tr> <tr><td>(S F M A)</td><td>Surge Wrasse (<i>T. purpureum</i>)</td></tr> <tr><td>(S F M A)</td><td>Twospot Wrasse (<i>O. bimaculatus</i>)</td></tr> <tr><td>(S F M A)</td><td>Yellowstriped Coris (<i>C. flavovittata</i>) E</td></tr> <tr><td>(S F M A)</td><td>Yellowtail Coris (<i>C. gaimard</i>)</td></tr> <tr><td colspan="2"><b>OTHER</b></td></tr> <tr><td>(S F M A)</td><td>Anchovy sp. (<i>Encrasicholina</i> sp.)</td></tr> <tr><td>(S F M A)</td><td>Chub (Gray/Highfin/Lowfin) (<i>Kyphosus</i> sp.)</td></tr> <tr><td>(S F M A)</td><td>Flagtail, Hawaiian (<i>K. sandvicensis</i>) E</td></tr> <tr><td>(S F M A)</td><td>Frogfish, Commerson's (<i>A. commerson</i>)</td></tr> <tr><td>(S F M A)</td><td>Gurnard, Helmet (Flying) (<i>D. orientalis</i>)</td></tr> <tr><td>(S F M A)</td><td>Lizardfish, Ulao (<i>S. ulao</i>)</td></tr> <tr><td>(S F M A)</td><td>Lizardfish, Reef (<i>S. variegatus</i>)</td></tr> <tr><td>(S F M A)</td><td>Milkfish (<i>C. chanos</i>)</td></tr> <tr><td>(S F M A)</td><td>Moorish Idol (<i>Z. cornutus</i>)</td></tr> <tr><td>(S F M A)</td><td>Orbicular Velvetfish, Hawaiian (<i>C. typicus</i>) E</td></tr> <tr><td>(S F M A)</td><td>Sandperch, Redspotted (<i>P. schauinslandii</i>)</td></tr> <tr><td>(S F M A)</td><td>Silverside, Hawaiian (<i>A. insularum</i>) E</td></tr> <tr><td>(S F M A)</td><td>Tilefish, Flagtail (<i>M. brevirostris</i>)</td></tr> </table>	<b>SURGEONFISH</b>		(S F M A)	Achilles Tang ( <i>A. achilles</i> )	(S F M A)	Black Surgeonfish ( <i>C. hawaiiensis</i> )	(S F M A)	Bluelined Surgeonfish ( <i>A. nigroris</i> )	(S F M A)	Brown Surgeonfish ( <i>A. nigrofuscus</i> )	(S F M A)	Convict Tang ( <i>A. triostegus</i> )	(S F M A)	Eyestripe Surgeonfish ( <i>A. dussumieri</i> )	(S F M A)	Golding Surgeonfish ( <i>C. strigosus</i> )	(S F M A)	Orangeband Surgeonfish ( <i>A. olivaceus</i> )	(S F M A)	Ringtail Surgeonfish ( <i>A. blochii</i> )	(S F M A)	Sailfin Tang ( <i>Z. veliferum</i> )	(S F M A)	Thompson's Surgeonfish ( <i>A. thompsoni</i> )	(S F M A)	Whitebar Surgeonfish ( <i>A. leucopareius</i> )	(S F M A)	Whitespotted Surgeonfish ( <i>A. guttatus</i> )	(S F M A)	Yellow Tang ( <i>Z. flavescens</i> )	(S F M A)	Yellowfin Surgeonfish ( <i>A. xanthopterus</i> )	<b>TRIGGERFISH</b>		(S F M A)	Black Durgon ( <i>M. niger</i> )	(S F M A)	Bridled Triggerfish ( <i>S. fraenatus</i> )	(S F M A)	Crosshatch Triggerfish ( <i>X. mento</i> )	(S F M A)	Gilded Triggerfish ( <i>X. auromarginatus</i> )	(S F M A)	Lagoon Triggerfish ( <i>R. aculeatus</i> )	(S F M A)	Lei Triggerfish ( <i>S. bursa</i> )	(S F M A)	Pinktail Durgon ( <i>M. vidua</i> )	(S F M A)	Reef (Picasso) Triggerfish ( <i>R. rectangulus</i> )	<b>UNICORNFISH (SURGEONFISH)</b>		(S F M A)	Bluespine Unicornfish ( <i>N. unicornis</i> )	(S F M A)	Orangespine Unicornfish ( <i>N. lituratus</i> )	(S F M A)	Paletail Unicornfish ( <i>N. brevirostris</i> )	(S F M A)	Sleek Unicornfish ( <i>N. hexacanthus</i> )	<b>WRASSE</b>		(S F M A)	Belted Wrasse ( <i>S. balteata</i> ) E	(S F M A)	Bird Wrasse ( <i>G. varius</i> )	(S F M A)	Blacktail (Old Woman) Wrasse ( <i>T. ballieui</i> ) E	(S F M A)	Blackside Razorfish ( <i>X. umbrilatus</i> ) E	(S F M A)	Christmas Wrasse ( <i>T. triolatum</i> )	(S F M A)	Cigar Wrasse ( <i>C. inermis</i> )	(S F M A)	Disappearing Wrasse ( <i>P. evanidus</i> )	(S F M A)	Eightstripe Wrasse ( <i>P. octotaenia</i> )	(S F M A)	Elegant Coris ( <i>C. venusta</i> ) E	(S F M A)	Flame Wrasse ( <i>C. jordani</i> ) E	(S F M A)	Fourstripe Wrasse ( <i>P. tetrataenia</i> )	(S F M A)	Hawaiian Cleaner Wrasse ( <i>L. phthiophagus</i> ) E	(S F M A)	Hawaiian Hogfish ( <i>B. bilunulatus</i> ) E	(S F M A)	Hawaiian Knifefish ( <i>C. lecluse</i> ) E	(S F M A)	Lined Coris ( <i>C. ballieui</i> )	(S F M A)	Ornate Wrasse ( <i>H. ornatus</i> )	(S F M A)	Peacock Razorfish ( <i>X. pavo</i> )	(S F M A)	Pearl Wrasse ( <i>A. cuvier</i> ) E	(S F M A)	Psychedelic Wrasse ( <i>A. chrysocephalus</i> ) E	(S F M A)	Ringtail Wrasse ( <i>O. unifasciatus</i> )	(S F M A)	Rockmover Wrasse ( <i>N. taeniurus</i> )	(S F M A)	Saddle Wrasse ( <i>T. duperrey</i> ) E	(S F M A)	Shortnose Wrasse ( <i>M. geoffroy</i> ) E	(S F M A)	Smalltail (Pencil) Wrasse ( <i>P. cerasinus</i> )	(S F M A)	Surge Wrasse ( <i>T. purpureum</i> )	(S F M A)	Twospot Wrasse ( <i>O. bimaculatus</i> )	(S F M A)	Yellowstriped Coris ( <i>C. flavovittata</i> ) E	(S F M A)	Yellowtail Coris ( <i>C. gaimard</i> )	<b>OTHER</b>		(S F M A)	Anchovy sp. ( <i>Encrasicholina</i> sp.)	(S F M A)	Chub (Gray/Highfin/Lowfin) ( <i>Kyphosus</i> sp.)	(S F M A)	Flagtail, Hawaiian ( <i>K. sandvicensis</i> ) E	(S F M A)	Frogfish, Commerson's ( <i>A. commerson</i> )	(S F M A)	Gurnard, Helmet (Flying) ( <i>D. orientalis</i> )	(S F M A)	Lizardfish, Ulao ( <i>S. ulao</i> )	(S F M A)	Lizardfish, Reef ( <i>S. variegatus</i> )	(S F M A)	Milkfish ( <i>C. chanos</i> )	(S F M A)	Moorish Idol ( <i>Z. cornutus</i> )	(S F M A)	Orbicular Velvetfish, Hawaiian ( <i>C. typicus</i> ) E	(S F M A)	Sandperch, Redspotted ( <i>P. schauinslandii</i> )	(S F M A)	Silverside, Hawaiian ( <i>A. insularum</i> ) E	(S F M A)	Tilefish, Flagtail ( <i>M. brevirostris</i> )
<b>HAWKFISH</b>																																																																																																																																																																																																																																																																																							
(S F M A)	Arc-Eye Hawkfish ( <i>P. arcatus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Blackside Hawkfish ( <i>P. forsteri</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Redbarred Hawkfish ( <i>C. fasciatus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Stocky Hawkfish ( <i>C. pinnulatus</i> )																																																																																																																																																																																																																																																																																						
<b>JACK</b>																																																																																																																																																																																																																																																																																							
(S F M A)	Bigeye Scad ( <i>S. crumenophthalmus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Bluefin Trevally ( <i>C. melampygus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Giant Trevally ( <i>C. ignobilis</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Golden Trevally ( <i>G. speciosus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Leatherback ( <i>S. lysan</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Mackerel Scad ( <i>D. macarellus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Rainbow Runner ( <i>E. bipinnulata</i> )																																																																																																																																																																																																																																																																																						
<b>LONGFISH</b>																																																																																																																																																																																																																																																																																							
(S F M A)	Bluestriped Pipefish ( <i>D. exisus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Cornetfish ( <i>F. commersonii</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Halfbeak sp. ( <i>Hemiramphus</i> sp.)																																																																																																																																																																																																																																																																																						
(S F M A)	Houndfish ( <i>T. crocodilus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Keeltail Needlefish ( <i>P. argalus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Redstripe Pipefish ( <i>D. baldwini</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Trumpetfish ( <i>A. chinensis</i> )																																																																																																																																																																																																																																																																																						
<b>MULLET and THREADFIN</b>																																																																																																																																																																																																																																																																																							
(S F M A)	Sharpnose Mullet ( <i>N. leuciscus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Six-Fingered (Moi) Threadfin ( <i>P. sexfilis</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Striped Mullet ( <i>M. cephalus</i> )																																																																																																																																																																																																																																																																																						
<b>PARROTFISH</b>																																																																																																																																																																																																																																																																																							
(S F M A)	Bullethead Parrotfish ( <i>C. sordidus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Palenose Parrotfish ( <i>S. psittacus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Redlip Parrotfish ( <i>S. rubroviolaceus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Spectacled Parrotfish ( <i>C. perspicillatus</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Stareye Parrotfish ( <i>C. carolinus</i> )																																																																																																																																																																																																																																																																																						
<b>PUFFERFISH</b>																																																																																																																																																																																																																																																																																							
(S F M A)	Ambon Toby ( <i>C. amboinensis</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Crown Toby ( <i>C. coronata</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Hawaiian Whitespotted Toby ( <i>C. jactator</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Lantern Toby ( <i>C. epilampra</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Maze Toby ( <i>C. rivulata</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Porcupinefish ( <i>D. hystrix</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Spiny Balloonfish ( <i>D. holocanthus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Spotted Puffer ( <i>A. meleagris</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Stripebelly Puffer ( <i>A. hispidus</i> )																																																																																																																																																																																																																																																																																						
<b>RAY</b>																																																																																																																																																																																																																																																																																							
(S F M A)	Broad Stringray ( <i>D. latus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Manta Ray ( <i>M. birostris</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Spotted Eagle Ray ( <i>A. narinari</i> )																																																																																																																																																																																																																																																																																						
<b>SCORPIONFISH</b>																																																																																																																																																																																																																																																																																							
(S F M A)	Devil Scorpionfish ( <i>S. diabolus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Hawaiian Lionfish ( <i>D. barberi</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Hawaiian Turkeyfish ( <i>P. sphex</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Leaf Scorpionfish ( <i>T. triacanthus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Titan Scorpionfish ( <i>S. cacopsis</i> ) E																																																																																																																																																																																																																																																																																						
<b>SHARK</b>																																																																																																																																																																																																																																																																																							
(S F M A)	Blacktip Reef Shark ( <i>C. melanopterus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Gray Reef Shark ( <i>C. amblyrhynchus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Whitetip Reef Shark ( <i>T. obesus</i> )																																																																																																																																																																																																																																																																																						
<b>SNAPPER and EMPEROR</b>																																																																																																																																																																																																																																																																																							
(S F M A)	Bigeye Emperor ( <i>M. grandoculis</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Blacktail Snapper ( <i>L. fulvus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Bluestripe Snapper ( <i>L. kasmira</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Green Jobfish (Gray Snapper) ( <i>A. virescens</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Smalltooth Jobfish (Forktail Snapper) ( <i>A. furca</i> )																																																																																																																																																																																																																																																																																						
<b>SQUIRRELFISH</b>																																																																																																																																																																																																																																																																																							
(S F M A)	Bigscale Soldierfish ( <i>M. berndti</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Crown Squirrelfish ( <i>S. diadema</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Epaulette Soldierfish ( <i>M. kuntee</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Hawaiian Squirrelfish ( <i>S. xantherythrum</i> ) E																																																																																																																																																																																																																																																																																						
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(S F M A)	Black Surgeonfish ( <i>C. hawaiiensis</i> )																																																																																																																																																																																																																																																																																						
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(S F M A)	Convict Tang ( <i>A. triostegus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Eyestripe Surgeonfish ( <i>A. dussumieri</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Golding Surgeonfish ( <i>C. strigosus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Orangeband Surgeonfish ( <i>A. olivaceus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Ringtail Surgeonfish ( <i>A. blochii</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Sailfin Tang ( <i>Z. veliferum</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Thompson's Surgeonfish ( <i>A. thompsoni</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Whitebar Surgeonfish ( <i>A. leucopareius</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Whitespotted Surgeonfish ( <i>A. guttatus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Yellow Tang ( <i>Z. flavescens</i> )																																																																																																																																																																																																																																																																																						
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(S F M A)	Black Durgon ( <i>M. niger</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Bridled Triggerfish ( <i>S. fraenatus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Crosshatch Triggerfish ( <i>X. mento</i> )																																																																																																																																																																																																																																																																																						
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(S F M A)	Lagoon Triggerfish ( <i>R. aculeatus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Lei Triggerfish ( <i>S. bursa</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Pinktail Durgon ( <i>M. vidua</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Reef (Picasso) Triggerfish ( <i>R. rectangulus</i> )																																																																																																																																																																																																																																																																																						
<b>UNICORNFISH (SURGEONFISH)</b>																																																																																																																																																																																																																																																																																							
(S F M A)	Bluespine Unicornfish ( <i>N. unicornis</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Orangespine Unicornfish ( <i>N. lituratus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Paletail Unicornfish ( <i>N. brevirostris</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Sleek Unicornfish ( <i>N. hexacanthus</i> )																																																																																																																																																																																																																																																																																						
<b>WRASSE</b>																																																																																																																																																																																																																																																																																							
(S F M A)	Belted Wrasse ( <i>S. balteata</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Bird Wrasse ( <i>G. varius</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Blacktail (Old Woman) Wrasse ( <i>T. ballieui</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Blackside Razorfish ( <i>X. umbrilatus</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Christmas Wrasse ( <i>T. triolatum</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Cigar Wrasse ( <i>C. inermis</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Disappearing Wrasse ( <i>P. evanidus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Eightstripe Wrasse ( <i>P. octotaenia</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Elegant Coris ( <i>C. venusta</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Flame Wrasse ( <i>C. jordani</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Fourstripe Wrasse ( <i>P. tetrataenia</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Hawaiian Cleaner Wrasse ( <i>L. phthiophagus</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Hawaiian Hogfish ( <i>B. bilunulatus</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Hawaiian Knifefish ( <i>C. lecluse</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Lined Coris ( <i>C. ballieui</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Ornate Wrasse ( <i>H. ornatus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Peacock Razorfish ( <i>X. pavo</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Pearl Wrasse ( <i>A. cuvier</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Psychedelic Wrasse ( <i>A. chrysocephalus</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Ringtail Wrasse ( <i>O. unifasciatus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Rockmover Wrasse ( <i>N. taeniurus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Saddle Wrasse ( <i>T. duperrey</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Shortnose Wrasse ( <i>M. geoffroy</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Smalltail (Pencil) Wrasse ( <i>P. cerasinus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Surge Wrasse ( <i>T. purpureum</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Twospot Wrasse ( <i>O. bimaculatus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Yellowstriped Coris ( <i>C. flavovittata</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Yellowtail Coris ( <i>C. gaimard</i> )																																																																																																																																																																																																																																																																																						
<b>OTHER</b>																																																																																																																																																																																																																																																																																							
(S F M A)	Anchovy sp. ( <i>Encrasicholina</i> sp.)																																																																																																																																																																																																																																																																																						
(S F M A)	Chub (Gray/Highfin/Lowfin) ( <i>Kyphosus</i> sp.)																																																																																																																																																																																																																																																																																						
(S F M A)	Flagtail, Hawaiian ( <i>K. sandvicensis</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Frogfish, Commerson's ( <i>A. commerson</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Gurnard, Helmet (Flying) ( <i>D. orientalis</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Lizardfish, Ulao ( <i>S. ulao</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Lizardfish, Reef ( <i>S. variegatus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Milkfish ( <i>C. chanos</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Moorish Idol ( <i>Z. cornutus</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Orbicular Velvetfish, Hawaiian ( <i>C. typicus</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Sandperch, Redspotted ( <i>P. schauinslandii</i> )																																																																																																																																																																																																																																																																																						
(S F M A)	Silverside, Hawaiian ( <i>A. insularum</i> ) E																																																																																																																																																																																																																																																																																						
(S F M A)	Tilefish, Flagtail ( <i>M. brevirostris</i> )																																																																																																																																																																																																																																																																																						



(S) (F) (M) (A) Green Sea Turtle **with** fibropapillomatosis (FP) Tumor  
(S) (F) (M) (A) Green Sea Turtle **without** FP tumor (*C. mydas*)

Green sea turtle FPs appear as lobe-shaped tumors that infect all soft portions of a turtle's body (primarily on the skin, but also between scales and scutes, in the mouth, on the eyes, and on internal organs).

Fill in the date of the survey. If the survey spanned multiple days, enter the date of the first survey. Note: An S Survey should not exceed 30 days.

MO		DAY		YR		
0	0	0	0	0	0	0
1		1	1	1	1	1
	2		2	2	2	2
	3		3		3	3
	4		4		4	4
	5		5		5	5
	6		6		6	6
	7		7		7	7
	8		8		8	8
	9		9		9	9

Record the water temperature at the surface and near the bottom (S&A only). Indicate Fahrenheit or Celsius.

°F or  °C

S	
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

B	
0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9

Fill in the total number of minutes spent surveying. For an S Survey, fill in the total number of minutes for all dives.

MIN		
0	0	0
1	1	1
2	2	2
3	3	3
4	4	4
5	5	5
6	6	6
7	7	7
8	8	8
9	9	9

Fill in the time at the start of the dive to the nearest hour.

- |                              |                               |                                |
|------------------------------|-------------------------------|--------------------------------|
| <input type="radio"/> 1 a.m. | <input type="radio"/> 9 a.m.  | <input type="radio"/> 5 p.m.   |
| <input type="radio"/> 2 a.m. | <input type="radio"/> 10 a.m. | <input type="radio"/> 6 p.m.   |
| <input type="radio"/> 3 a.m. | <input type="radio"/> 11 a.m. | <input type="radio"/> 7 p.m.   |
| <input type="radio"/> 4 a.m. | <input type="radio"/> Noon    | <input type="radio"/> 8 p.m.   |
| <input type="radio"/> 5 a.m. | <input type="radio"/> 1 p.m.  | <input type="radio"/> 9 p.m.   |
| <input type="radio"/> 6 a.m. | <input type="radio"/> 2 p.m.  | <input type="radio"/> 10 p.m.  |
| <input type="radio"/> 7 a.m. | <input type="radio"/> 3 p.m.  | <input type="radio"/> 11 p.m.  |
| <input type="radio"/> 8 a.m. | <input type="radio"/> 4 p.m.  | <input type="radio"/> Midnight |

Fill in the estimated horizontal visibility where most of the survey was taken.

- ☐ under 10'  
☐ 10'–24'  
☐ 25'–49'  
☐ 50'–74'  
☐ 75'–99'  
☐ 100'–149'  
☐ over 149'

Fill in the depth range where most of the survey was taken.

- ☐ Snorkel  
☐ under 10'  
☐ 10'-19'  
☐ 20'-29'  
☐ 30'-39'  
☐ 40'-49'  
☐ 50'-59'  
☐ 60'-69'  
☐ 70'-79'  
☐ 80'-89'  
☐ 90'-99'  
☐ 100'-109'  
☐ 110'-119'  
☐ 120'-129'

\_\_\_\_\_

Fill in the current encountered:

- ☐ Strong  
☐ Weak  
☐ None

Strong—difficult to swim against; Weak—noticeable but does not seriously effect dive; None—slight or no current.

Fill in the habitat over which a majority of the dive was made.

**Habitats:**

- ☐ High Profile Reef
- ☐ Low Profile Reef
- ☐ Rocky Boulders/Volcanic
- ☐ Wall
- ☐ Ledge
- ☐ Sand
- ☐ Artificial

**High Profile Reef** is a reef where most structures rise four or more feet off the bottom.

**Low Profile Reef** is a reef where most structures average less than four feet off the bottom.

**Rocky Boulders/Volcanic** is where the bottom consists of ridges, tunnels, caverns or boulders that were formed by volcanic lava.

A **Wall** is a sheer dropoff of over 25 feet that faces open water.

A **Ledge** is a single or few sharp drops in bottom topography of three or more feet that may or may not face open water.

**Sand** is where the bottom is mostly sand.

**Artificial** includes ship wrecks, platforms, dumped debris or other artificially created habitat.

**UNLISTED FISH SPECIES** Give common and scientific name if known. In addition to Green Sea Turtles above, please also include here any other sea turtle sightings\*.

S F M A

S F M A

S F M A

S F M A

S F M A

S F M A

S F M A

S F M A

S F M A

**Please do not write in this area**

[illegible]

\*Identify the species if possible; otherwise list "unidentified sea turtle." Visit [www.reef.org/seaturtle.htm](http://www.reef.org/seaturtle.htm) for more information.

NOTE: Write any additional fish species on a separate piece of paper and reference the form number printed below.

13771

PLEASE DO NOT WRITE IN THIS SHADED AREA



## Pacific Remote Islands National Wildlife Refuge Special Use Permit Application

Please Send Special Use Permit Applications to:

Special Use Permit Coordinator  
Pacific Remote Islands National Wildlife Refuge Complex  
P.O. Box 50167  
300 Ala Moana Blvd, Rm 5-231  
Honolulu, HI 96850  
808-792-9550

### Type of Special Use

- ☒ I am applying for a **Research** permit. (Complete and mail Application A)
  - ☒ This application is for a NEW project on the National Wildlife Refuge(s).
  - ☐ This application is for an ANNUAL RENEWAL of a previously permitted project on the National Wildlife Refuge(s). Previous permit number .
  
- ☐ I am applying for a **Monitoring** permit. (Complete and mail Application A)
  - ☐ This application is for a NEW project on the National Wildlife Refuge(s).
  - ☐ This application is for an ANNUAL RENEWAL of a previously permitted project on the National Wildlife Refuge(s) (including Permanent or Semi-permanent installations). Previous permit number .
  
- ☐ I am applying for a permit for a **Vessel** to be used as a support platform for other permitted activities on the National Wildlife Refuge(s). (Complete and mail Application A)
  - ☐ This application is for a NEW project on the National Wildlife Refuge(s).
  - ☐ This application is for an ANNUAL RENEWAL of a previously permitted project on the National Wildlife Refuge(s). Previous permit number .

and Hermes Atoll;

- 4) gain first-hand familiarity snorkeling in the ecologically diverse coral reef ecosystem of the NW Hawaiian Islands to interpret these experiences to reach broader audiences through established education and outreach methods;
- 5) provide a venue and mechanisms for participating teachers to share and distribute the materials they develop and their experience to other educators, schoolchildren and the general public;
- 6) deploy and recover the AULS in support of the Sanctuary Sounds project;
- 7) enhance the general understanding of the NWHI ecosystems and resources through education and outreach in collaboration with NWHICRER and State education partners.

Describe how your proposed project will help provide information or resources to fulfill the National Wildlife Refuge purpose and to reach the Refuge goals and objectives.

Experiential education is the cornerstone for change, and exposure of a select group of educators to the unique environments of the Hawaiian Islands National Wildlife Refuge will have a ripple effect through the broader Hawai'i education community. This will likely inspire other teachers to learn more about the NWHI and teach about them in their classrooms. Since it would be too great an impact to bring a large number of educators to the NWHI for a first hand experience, NOAA and its Federal and State education partners have pursued the strategy of bringing select teachers on education and research expeditions so that they can bring back their experience and share it with others. Thus, broadening awareness without having a major influence on the habitat for threatened and endangered species found in the Hawaiian Islands National Wildlife Refuge. A few examples of this ripple effect from the August 2005 education cruise to the NWHI includes: State of Hawai'i standards-based lesson plans that compliment the Navigating Change curriculum are available for download on partner website <http://hawaiianatolls.org>; a school play titled "Heart of Honu" focused on conservation in the NWHI coral reef ecosystem; newspaper articles with stunning imagery targeted at the public-at-large (i.e. Honolulu Advertiser); Hawaiian music and chants focused on the NWHI; and regionally and nationally significant conference presentations with personal accounts from educators that touch the hearts of those present and inspire conservation.

Since the NWHICRER is undergoing the public sanctuary designation process, interpreting the research being conducted at this remote location through the writing of compelling web expedition logs, newspaper articles, and lesson plans will broaden the outreach to a much larger audience. The impact of these education and outreach activities will ensure the public learns more about this remote archipelago to promote the NWHI's unique marine resources and ecosystems for present and future generations.

Lastly, public domain images and data collected during this cruise will be made available to all State and Federal partners through the NWHICRER, and education content will be posted to the partner website: <http://hawaiianatolls.org>. The images and video will be available before the end of 2006 through a newly developed Media Library that will provide broader and more distributed access. This web-based media storage and distribution system is being developed by the NOAA NMSP and is currently in the beta testing phase.

Describe context of this research include history of the science for these questions and background of the research.

Education and outreach activities proposed for the NOAA ship Hi'ialakai research cruise will include the interpretation of the mapping and maritime heritage archaeology research for a broader audience through scientist interviews, pod casting, web-based expedition logs, newspaper articles, standards-based lesson plans and other established methods. Having educators aboard the research cruise allows them to observe and learn first hand about the research being conducted to better understand and manage the State of Hawai'i Marine Refuge, NWHICRER and the Hawaiian Islands National Wildlife Refuge.

Knowledge of the NWHI and the unique marine and terrestrial resources found in this special ocean region is very limited. Even in Hawai'i knowledge and understanding of the NWHI is poor. Many people in Hawai'i do not even know of the area's existence. Although knowledge levels are improving, many schoolchildren still are not even taught about the leeward islands of the

In education and outreach, the recordings will offer multiple opportunities for product development. The first product will be a series of radio messages for use in national and regional public awareness campaigns. The NWHICRER, State and Federal educational partners will have the opportunity to use these sounds in support of sanctuary designation and to broaden ocean literacy. Through the use of sounds, listeners feel as if they are at the site being described or are near the vocalizing creature. This approach enables us to bring the Hawaiian Islands National Wildlife Refuge and the NWHICRER to a broad audience, rather than have them visit and potentially impact the reserve's wildlife and habitats.

Sanctuary Sounds will eventually be incorporated into the websites of each sanctuary and would significantly enhance the visitor's experience. Visitors to facilities such as aquariums and science centers with live video feeds from respective underwater marine protected areas could have a more reality based experience than one without sound. While not presently applicable, underwater and at surface sounds integrated into Geographic Information System programs could offer an innovative and unique opportunity.

Explain the need for this research and how it will help to enhance survival or recovery of refuge wildlife and habitats.

Proposed education and outreach activities may not appear to directly impact the survival or recovery of refuge wildlife and habitats, although through enhanced awareness, understanding and appreciation of this special ocean area, there will be more public support for protection of the NWHI for future generations. Broadening ocean literacy through education and outreach informs the public and in turn can provide support for future research and monitoring to assist management priorities.

Describe how your proposed project can help to better manage the National Wildlife Refuge or global communities.

The mission of managing, conserving and restoring unique marine ecosystems for present and future generations, is accomplished through research, monitoring, resource protection, as well as education and outreach. Through effective education and outreach activities and local, State and Federal partnerships, a larger audience can learn about the NWHI, which in turn makes them appreciate the resource more and want to protect it. Formal education also touches students of all ages, the future stewards of our aquatic resources and ecosystems. Interpreting the mapping and maritime heritage archaeology research aboard the NOAA ship Hi'ialakai cruise by formal and non-formal educators, as well as a media person will allow there to be broader impact of this and future research cruises taking place in the NWHI. This, in turn, will ultimately help better manage the NWHICRER and Hawaiian Islands National Wildlife Refuge.

10. Procedures (include equipment/materials) ☐ (graduate proposals attached)

The REEF fish survey data is collected using standardized protocols (roving diver technique) that are non-invasive to fish, marine mammals, turtles, or coral reef ecosystems. The primary means of data collection will include non-obtrusive visual observations while snorkeling. The equipment used includes waterproof datasheets attached to clipboards with pencils. Aboard the research vessel, the data is imported into the REEF online database, which is readily available for any resource manager as baseline data to use to make informed ecosystem-based management decisions. A REEF fish survey sample datasheet is attached to this permit request for reference.

The Sanctuary Sounds project will use an AULS to collect a complete record of natural and man-made underwater and at surface sounds from the NWHICRER, State of Hawai'i Marine Refuge and the Hawaiian Island National Wildlife Refuge. A two-person scuba team from a small boat will deploy and secure the AULS onto a sandy bottom habitat adjacent to the PEARL and HERMES whaling vessel shipwrecks off Pearl and Hermes Atoll. The AULS device will passively collect underwater sounds for approximately 60 hours, then will be retrieved. The AULS will have no physical impact on the sandy bottom habitat or surrounding wildlife. Once the data is retrieved, it will be sent to principle investigator Cathy Sakas and her collaborators to be processed for the NMSP Sanctuary Sounds project. This data will be readily available for use by education and outreach coordinators for the NWHICRER and State and Federal educational partners, as well as researchers, resource managers, and media people.

In all of the requested education and outreach activities that take place in the Hawaiian Islands National Wildlife Refuge - REEF fish surveys, photo documentation, observation and deployment of the AULS - no resources or ecosystems will be negatively

18. Gear and Materials
<p>Waterproof paper, clipboards and pencils are the required materials to conduct the REEF fish surveys. Snorkeling gear will be required for all REEF fish surveys, general observation dives and photo documentation in support of compelling education and outreach products. As mentioned previously, one member of the education team will be required to have traditional scuba diving equipment. A variety of still and video cameras with underwater housings will be available for use during passive observation dives and exclusively for the collection of images and video to accompany educational materials and newspaper article. Exact specs of cameras not available at this time.</p> <p>The AULS weighs 80 pounds with a 18" x 18" x 18" galvanized steel bottom mount and 9" dia. X 10" high pressure housing. This device will be placed unobtrusively on a sandy bottom habitat and stabilized to passively collect underwater man-made and natural sounds in support of the NMSP Sanctuary Sounds project.</p>
19. Permanent or semi-permanent installations and instrumentation.
No fixed instrumentation will be installed in the Hawaiian Islands National Wildlife Refuge. There is only a request for one temporary installation of the AULS on a sandy bottom habitat off Pearl and Hermes Atoll.
20. Request for volunteer maintenance of installations or collection of data and/or samples.
N/A
21. Transportation:
<p>How will personnel be transported to and from the National Wildlife Refuge(s)?</p> <p>The education team will travel to Pearl and Hermes Atoll on board the NOAA ship Hi'ialakai, a 220-foot T-AGOS class research vessel currently in use for conservation, science and education missions in the NWHI. The NOAA ship launches two jet drive Safe Boats (10m and 8m) and also launches inflatable zodiacs and/or small Boston whalers for snorkel and dive team field projects.</p>
<p>How will gear and materials be transported to and from the National Wildlife Refuge(s)?</p> <p>NOAA Ship Hi'ialakai</p>
<p>If transported by ship, how will personnel, gear and materials be transported between ship and shore?</p> <p>No planned shore operations.</p>
<p>If applicable, how will personnel be transported between islands within any one atoll?</p> <p>No planned shore operations.</p>
<p>How will personnel access species and habitat at the atoll (walking, climbing, wading, swimming, snorkeling, diving, etc.).</p> <p>Personnel will access survey sites by using the NOAA ship's small launches, and conducting diving and snorkeling operations from these platforms. At shallow sites in or near the lagoon reef crest, wading and snorkeling will be used. At all times the survey personnel will remain aware of the fragility of the natural ecosystem, and follow the appropriate and stipulated guidelines for the protection of corals, marine species, and marine mammals.</p>
<p>How will samples be transported off the island?</p> <p>No samples are being taken.</p>
<p>Provide a time line of all significant transportation events.</p> <p>June 22 NOAA ship Hi'ialakai departs Honolulu Harbor</p> <p>June 27 NOAA ship Hi'ialakai arrives Kure Atoll, State Wildlife Refuge</p> <p>July 5 NOAA ship Hi'ialakai departs Kure</p> <p>July 6 NOAA ship Hi'ialakai arrives Pearl and Hermes Atoll</p> <p>July 15 NOAA ship Hi'ialakai departs Pearl and Hermes Atoll</p> <p>July 19 NOAA ship Hi'ialakai arrives Honolulu Harbor</p>
22. Provide a time table for sample analysis, data analysis, write-up and publication of information.
<p>A summary descriptive project report including abstract, major accomplishments, participants, activity log, results of work to date will be completed within two months of the project. The web-based expedition log will be updated daily during the research</p>

